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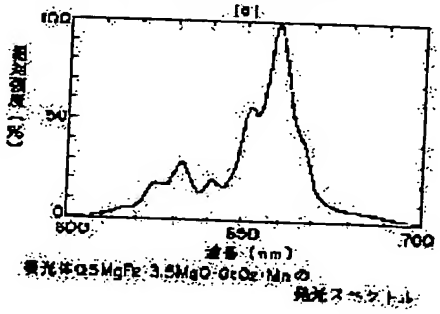
(54) SEMICONDUCTOR LIGHT EMITTING DEVICE AND LIGHT EMITTING DISPLAY COMPRISING IT

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a monochromatic semiconductor light emitting device having a good color tone and insusceptible to light emitted from a semiconductor light emitting element.
SOLUTION: The semiconductor light emitting device comprises a semiconductor light emitting element having an emission wavelength of 390-420 nm and emission color from near ultraviolet to violet blue where the visual sensitivity of human being is low, and the wavelength of light from the semiconductor light emitting element is converted by a fluorescent material having a monochromatic emission peak. When the visual sensitivity of human being is taken into account, the light subjected to wavelength conversion by the fluorescent material is apparently insusceptible to direct light from the semiconductor light emitting element, and thereby the light from the fluorescent material has a good color tone. Since a semiconductor light emitting device having a desired emission color can be obtained by simply varying the fluorescent material without varying the structure of the semiconductor light emitting device or the semiconductor light emitting element, fabrication cost of the semiconductor light emitting device can be reduced.



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CLAIMS

[Claim(s)]
[Claim 1] It is semi-conductor luminescence equipment characterized by for the above-mentioned semi-conductor light emitting device to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm in the semi-conductor luminescence equipment which comes to carry a semi-conductor light emitting device on a base, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 600nm thru/or 670nm with the fluorescent substance which carries out outgoing radiation of the red light which has the main luminescence peak.
[Claim 2] the semi-conductor luminescence equipment according to claim 1 characterized by the above-mentioned fluorescent substance consisting of any one or 2 or more M2O2 S:Eu (however, any one or two or more elements with which M is chosen from La, Gd, and Y), 0.5MgF2 and 3.5 MgO-GeO2:Mn, Y2O3:Eu, Y(P, V) O4:Eu, YVO4:Eu, and among the groups of a fluorescent substance come out of and expressed.
[Claim 3] It is semi-conductor luminescence equipment characterized by for the above-mentioned semi-conductor light emitting device to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm in the semi-conductor luminescence equipment which comes to carry a semi-conductor light emitting device on a base, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 500nm thru/or 540nm with the fluorescent substance which carries out outgoing radiation of the green light which has the main luminescence peak.
[Claim 4] the above-mentioned fluorescent substance -- RMg2aluminum16O27: -- Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) -- RMgAl10O17: -- Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) -- It Eu(s) and D(ies). ZnS:Cu, SrAl2O4:Eu, and SrAl2O4: -- ZnO:Zn, Zn2germanium2O4:Mn, Zn2SiO4:Mn, and Q3MgSi2O8:Eu -- Mn the semi-conductor luminescence equipment according to claim 3 characterized by consisting of any one or 2 or more however, (any one or two or more elements) with which Q is chosen from Sr, Ba, and calcium, and among the groups of a fluorescent substance come out of and expressed.
[Claim 5] It is semi-conductor luminescence equipment characterized by for the above-mentioned semi-conductor light emitting device to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm in the semi-conductor luminescence equipment which comes to carry a semi-conductor light emitting device on a base, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 410nm thru/or 480nm with the fluorescent substance which carries out outgoing radiation of the blue light which has the main luminescence peak.
[Claim 6] The above-mentioned fluorescent substance A10(PO4) 6Cl2:Eu (however, any one or two or more elements with which A is chosen from Sr, calcium, Ba, Mg, and Ce), XMg2aluminum16O27:Eu (however, any one as which X is chosen from Sr and Ba or both elements), XMgAl10O17:Eu (however, any one as which X is chosen from Sr and Ba or both elements), ZnS:Ag, Sr10(PO4) 6Cl2:Eu, calcium10(PO4) 6F2:Sb, Z3MgSi2O8:Eu (however, any one or two or more elements with which Z is chosen from Sr, Ba, and calcium), SrMgSi2O8:Eu, Sr2P2O7:Eu, and CaAl2O4: -- the semi-conductor luminescence equipment according to claim 5 characterized by consisting of any one or 2 or more Eu, Nd, and among the groups of a fluorescent substance come out of and expressed.
[Claim 7] It is semi-conductor luminescence equipment characterized by for the above-mentioned semi-conductor light emitting device to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm in the semi-conductor luminescence equipment which comes to carry a semi-conductor light emitting device on a base, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 480nm thru/or 500nm with the fluorescent substance which carries out outgoing radiation of the light of a bluish-green color which has the main luminescence peak.
[Claim 8] It Eu(s) and D(ies). the above-mentioned fluorescent substance -- Sr4aluminum14O25:Eu and Sr4aluminum14O25: -- L10(PO4) 6Cl2:Eu (however, any one or two or more elements with which L is chosen from Ba, calcium, and Mg), the semi-conductor luminescence equipment according to claim 7 characterized by consisting of any one or 2 or more Sr2Si3O8 and 2SrCl2:Eu, and among the groups of a fluorescent substance come out of and expressed.
[Claim 9] It is semi-conductor luminescence equipment characterized by for the above-mentioned semi-conductor light emitting device to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm in the semi-conductor luminescence equipment which comes to carry a semi-conductor light emitting device on a

base, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 570nm thru/or 600nm with the fluorescent substance which carries out outgoing radiation of the orange light which has the main luminescence peak.
[Claim 10] the semi-conductor luminescence equipment according to claim 9 characterized by the above-mentioned fluorescent substance consisting of any one or 2 or more ZnS:Mn, ZnS:Cu, Mn and Co, and among the groups of a fluorescent substance come out of and expressed.
[Claim 11] Claim 1 characterized by having closure resin which closes at least the part and the above-mentioned semi-conductor light emitting device of the above-mentioned base, and the above-mentioned closure resin containing the above-mentioned fluorescent substance thru/or semi-conductor luminescence equipment of any one publication of ten.
[Claim 12] It is semi-conductor luminescence equipment according to claim 11 characterized by for the above-mentioned base being a leadframe which has the mounting section of a cup configuration, and arranging the above-mentioned semi-conductor light emitting device at the bottom of the mounting section of the cup configuration of the above-mentioned leadframe, and for wire bonding connecting with another leadframe electrically, and closing at least the part and the above-mentioned semi-conductor light emitting device of the two above-mentioned leadframes by the above-mentioned closure resin.
[Claim 13] It is semi-conductor luminescence equipment according to claim 11 characterized by for the above-mentioned base being an insulator connected at the head of the leadframe of a couple, and connecting the above-mentioned semi-conductor light emitting device to metal wiring formed in the above-mentioned insulator, and closing at least the part, the above-mentioned insulator, and the above-mentioned semi-conductor light emitting device of a leadframe of a up Norikazu pair by the above-mentioned closure resin.
[Claim 14] The above-mentioned base is a leadframe which has the mounting section of a cup configuration. The above-mentioned semi-conductor light emitting device It is arranged at the bottom of the mounting section of the cup configuration of the above-mentioned leadframe. And while wire bonding connects with another leadframe electrically and the mounting section of the above-mentioned cup configuration is filled up with the above-mentioned fluorescent substance Claim 1 characterized by closing at least the part, the above-mentioned semi-conductor light emitting device, and the above-mentioned fluorescent substance of the two above-mentioned leadframes by closure resin thru/or semi-conductor luminescence equipment of any one publication of ten.
[Claim 15] The above-mentioned base is a leadframe which has the mounting section of a cup configuration. The above-mentioned semi-conductor light emitting device It is arranged at the bottom of the mounting section of the cup configuration of the above-mentioned leadframe. And while wire bonding connects with another leadframe electrically, filling up the mounting section of the above-mentioned cup configuration with a coating member and arranging the above-mentioned fluorescent substance on the above-mentioned coating member Claim 1 characterized by closing at least the part, the above-mentioned semi-conductor light emitting device, the above-mentioned coating member, and the above-mentioned fluorescent substance of the two above-mentioned leadframes by closure resin thru/or semi-conductor luminescence equipment of any one publication of ten.
[Claim 16] They are claim 1 which the above-mentioned base is the substrate with which metal wiring was given, and the above-mentioned semi-conductor light emitting device is electrically connected to metal wiring of the above-mentioned substrate, is equipped with the closure resin which closes the above-mentioned semi-conductor light emitting device, and is characterized by the above-mentioned closure resin containing the above-mentioned fluorescent substance thru/or semi-conductor luminescence equipment of any one publication of ten.
[Claim 17] They are claim 1 which the above-mentioned base is the substrate with which metal wiring was given, the above-mentioned semi-conductor light emitting device is arranged in the crevice while connecting with metal wiring of the above-mentioned substrate electrically, and is characterized by filling up with the above-mentioned fluorescent substance in the above-mentioned crevice thru/or semi-conductor luminescence equipment of any one publication of ten.
[Claim 18] The above-mentioned crevice is semi-conductor luminescence equipment according to claim 17 characterized by being formed with the frame arranged at the above-mentioned substrate.
[Claim 19] The above-mentioned base is claim 1 characterized by being the substrate with which metal wiring was given, arranging the above-mentioned semi-conductor light emitting device in the crevice while connecting with metal wiring of the above-mentioned substrate electrically, and arranging the above-mentioned fluorescent substance on the above-mentioned closure resin while filling up the above-mentioned crevice with closure resin thru/or semi-conductor luminescence equipment of any one publication of ten.
[Claim 20] The above-mentioned base is the substrate with which metal wiring was given. The above-mentioned semi-conductor light emitting device Connect with metal wiring and the electric target of the above-mentioned substrate, and it has the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device. Claim 1 characterized by having closure resin which the reflected light from the above-mentioned reflector penetrates while closing the above-mentioned semi-conductor light emitting device, and containing the above-mentioned fluorescent substance in the above-mentioned closure resin thru/or semi-conductor luminescence equipment of any one publication of ten.
[Claim 21] The above-mentioned base is the substrate with which metal wiring was given. The above-mentioned semi-conductor light emitting device Connect with the above-mentioned metal wiring and the electric target of the above-mentioned substrate, and it has the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device. The exterior of semi-conductor luminescence equipment is equipped with the screen which interrupts the light which carries out direct outgoing radiation from the above-

mentioned semi-conductor light emitting device. Claim 1 to which it has closure resin which the reflected light from the above-mentioned reflector penetrates while closing the above-mentioned semi-conductor light emitting device, and the layer of the above-mentioned fluorescent substance is characterized by being prepared in the field which light reflects in the above-mentioned reflector thru/or semi-conductor luminescence equipment of any one publication of ten.

[Claim 22] The above-mentioned base is the substrate with which metal wiring was given. The above-mentioned semi-conductor light emitting device Connect with the above-mentioned metal wiring and the electric target of the above-mentioned substrate, and a part for the light-emitting part of the above-mentioned semi-conductor light emitting device is arranged in the crevice of the above-mentioned substrate at least. It has the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device. Claim 1 to which it has closure resin which the reflected light from the above-mentioned reflector penetrates while closing the above-mentioned semi-conductor light emitting device, and the layer of the above-mentioned fluorescent substance is characterized by being prepared in the field which light reflects in the above-mentioned reflector thru/or semi-conductor luminescence equipment of any one publication of ten.

[Claim 23] The above-mentioned base is the substrate with which metal wiring was given. The above-mentioned semi-conductor light emitting device Connect with the above-mentioned metal wiring and the electric target of the above-mentioned substrate, and it has the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device. Claim 1 characterized by being prepared in the field as for which is equipped with the closure resin which the reflected light from the above-mentioned reflector penetrates while closing the above-mentioned semi-conductor light emitting device, and the light of the above-mentioned closure resin carries out [the layer of the above-mentioned fluorescent substance] outgoing radiation thru/or semi-conductor luminescence equipment of any one publication of ten.

[Claim 24] In the semi-conductor luminescence equipment which comes to carry a semi-conductor light emitting device on a base the above-mentioned semi-conductor light emitting device It has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, and has the 1st fluorescent substance, the 2nd fluorescent substance, and the 3rd fluorescent substance. The 1st fluorescent substance of the above It has a red outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 600nm thru/or 670nm. The 2nd fluorescent substance of the above It has a green outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 500nm thru/or 540nm. The 3rd fluorescent substance of the above Semi-conductor luminescence equipment with which it has a blue outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 410nm thru/or 480nm, and the sum of the color of the outgoing radiation light from the 1st, 2nd, and 3rd fluorescent substance of the above is characterized by being a white system.

[Claim 25] The 1st fluorescent substance of the above M2O2 S:Eu (however, any one or two or more elements with which M is chosen from La, Gd, and Y), 0.5MgF2 and 3.5 MgO-GeO2:Mn, Y2O3:Eu, It consists of any one or 2 or more Y(P, V) O4:Eu, YVO4:Eu, and among the groups of a fluorescent substance come out of and expressed. the 2nd fluorescent substance of the above RMg2aluminum16O27: -- Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) -- RMgAl10O17: -- Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) -- It Eu(s) and D(ies). ZnS:Cu, SrAl2O4:Eu, and SrAl2O4: -- ZnO:Zn, Zn2germanium2O4:Mn, Zn2SiO4:Mn, and Q3MgSi2O8:Eu -- Mn It consists of any one or 2 or more however, (any one or two or more elements) with which Q is chosen from Sr, Ba, and calcium, and among the groups of a fluorescent substance come out of and expressed. the 3rd fluorescent substance of the above A10(PO4) 6Cl2:Eu (however, any one or two or more elements with which A is chosen from Sr, calcium, Ba, Mg, and Ce), XMg2aluminum16O27:Eu (however, any one as which X is chosen from Sr and Ba or both elements), XMgAl10O17:Eu (however, any one as which X is chosen from Sr and Ba or both elements), ZnS:Ag, Sr10(PO4) 6Cl2:Eu, calcium10 (PO4) 6F2:Sb, Z3MgSi2O8:Eu (however, any one or two or more elements with which Z is chosen from Sr, Ba, and calcium), SrMgSi2O8:Eu, Sr2P2O7:Eu, and CaAl2O4: -- the semi-conductor luminescence equipment according to claim 24 characterized by consisting of any one or 2 or more Eu, Nd, and among the groups of a fluorescent substance come out of and expressed.

[Claim 26] For 20 or less % of the weight and the 3rd fluorescent substance of the 7-% of the weight or more above, 70 or less % of the weight and the 2nd fluorescent substance of the 50-% of the weight or more above are [the 1st, 2nd, and 3rd fluorescent substance of the above] semi-conductor luminescence equipment according to claim 24 or 25 with which it is characterized by the 1st fluorescent substance of the above being 30 or less % of the weight 20 % of the weight or more noting that a total amount is 100 % of the weight.

[Claim 27] The above-mentioned closure resin is semi-conductor luminescence equipment according to claim 26 with which the 1st, 2nd, and 3rd fluorescent substance of the above is included, and the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance of the above to the weight of the above-mentioned closure resin is characterized by or more 0.5 being one or less.

[Claim 28] It is the luminescence display which is equipped with the light source using claim 24 thru/or the semi-conductor luminescence equipment of any one publication of 27, the light guide plate to which the light from the above-mentioned light source is led, and the light filter of green [which are made to penetrate the light from the above-mentioned light guide plate, and carry out a spectrum / the red and green], and blue, and is characterized by for the outgoing radiation light of the above-mentioned semi-conductor luminescence equipment to have the wavelength distribution which suited the spectral characteristic of the above-mentioned light filter.

[Claim 29] So that wavelength distribution of the outgoing radiation light of semi-conductor luminescence equipment

may suit the spectral characteristic of the above-mentioned light filter The luminescence wavelength of the above-mentioned semi-conductor light emitting device, and the luminescence wavelength of the 1st fluorescent substance of the above, The luminescence wavelength of the 2nd fluorescent substance of the above, the luminescence wavelength of the 3rd fluorescent substance of the above, and the mixed ratio of the 1st, 2nd, and 3rd fluorescent substance of the above, The luminescence display according to claim 28 characterized by adjusting at least one of the ratios of the AUW of the 1st, 2nd, and 3rd fluorescent substance of the above to the weight of the above-mentioned closure resin.

[Claim 30] The above-mentioned luminescence display is a luminescence display according to claim 28 or 29 characterized by being a liquid crystal display.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention The light sources for back lights, such as a liquid crystal display, and a cellular phone, a Personal Digital Assistant, the indicator of the LED (light emitting diode) indicating equipment used for an announcement indoor outside etc., and an each kind pocket device -- It is a thing about the semi-conductor luminescence equipment used for the light source for an illumination switch and OA (office automation) devices etc. Especially, wavelength conversion of the outgoing radiation light from a semi-conductor light emitting device is carried out using a fluorescent substance, and it is related with semi-conductor luminescence equipment available as the light source of various luminescent color, and the luminescence display using it.
[0002]
[Description of the Prior Art] Semi-conductor luminescence equipment is small, and since power consumption can carry out high brightness luminescence to stability few, it is widely used as the light source in various displays. Moreover, semi-conductor luminescence equipment is used also as the light source for information record reading in various information processors. Green high brightness luminescence was possible for the semi-conductor light emitting device used for the long wavelength light semi-conductor luminescence equipment put in practical use widely until now from red by a semiconductor material, formation conditions, etc. of a luminous layer which are used. On the other hand, from blue, the semi-conductor light emitting device which emits light in the purple short wavelength light is developed, and, generally it is beginning to be put in practical use in recent years.
[0003] The LED display using the semi-conductor luminescence equipment which has the luminescent color of R (red), G (green), and B (blue) in three primary colors has begun to appear in the commercial scene, using the semi-conductor luminescence equipment of these various luminescent color.
[0004] Furthermore, the semi-conductor luminescence equipment which obtains white from blue combining the semi-conductor light emitting device and fluorescent substance which emit light in the purple short wavelength light with color mixture with the conversion light by which wavelength conversion was carried out with the outgoing radiation light and the fluorescent substance of a semi-conductor light emitting device is indicated by patent No. 2927279.
[0005] Moreover, in order to obtain the compact white luminescent color by high brightness, the semi-conductor luminescence equipment which combined the semi-conductor light emitting device which has the luminescent color of blue or a purple-blue color, and one sort or two kinds or more of fluorescent substances which absorb the light from this semi-conductor light emitting device, and emit light in the light of a visible region is indicated by JP,10-163535,A. The above-mentioned fluorescent substance is chosen so that the luminescent color of the above-mentioned semi-conductor light emitting device and the luminescent color of a fluorescent substance may become the relation of the complementary color mutually, the luminescent color of this semi-conductor light emitting device and the luminescent color of a fluorescent substance may be added and light may be emitted white.
[0006] Moreover, the semi-conductor luminescence equipment which equips JP,10-12925,A with the semi-conductor light emitting device which carries out outgoing radiation of ultraviolet radiation and the near-ultraviolet light, and the fluorescent substance which emits fluorescence by the light from this semi-conductor light emitting device is indicated. The above-mentioned semi-conductor light emitting device is a semi-conductor light emitting device which usually emits a blue light, and carries out outgoing radiation of ultraviolet radiation and the near-ultraviolet light by passing a pulse-like high current. Obtaining two or more luminescent color, using the semi-conductor light emitting device of a single class only by changing the class of the above-mentioned fluorescent substance is indicated.
[0007] Moreover, the display equipped with red, blue, and three kinds of fluorescent substance layers that emit light respectively in the green three primary colors dot-matrix type is indicated by JP,9-153644,A by receiving the ultraviolet rays from the luminous layer which is formed using 3 group nitrogen ghost semi-conductor, and emits light in the ultraviolet rays whose peak wavelength is 380nm, and this luminous layer.
[0008]
[Problem(s) to be Solved by the Invention] However, the above-mentioned Prior art has the following troubles.
[0009] The semi-conductor light emitting device which emits light the purple short wavelength light from the semi-conductor light emitting device which is used for long wavelength light semi-conductor luminescence equipment, and has the green luminescent color from red, and blue Since the ingredient and component configuration which are used according to the wavelength which emits light differ from each other, if the semiconductor device of mutually

different wavelength tends to be mounted and it is going to obtain semi-conductor luminescence equipment Two or more mutually different mounting ingredients and mounting processes are needed, and while a production process becomes complicated, there is a problem of becoming the factor of a cost rise.

[0010] Furthermore, in order for color to acquire the good white light using two or more semi-conductor light emitting devices from which the above-mentioned luminescent color differs mutually, since it is necessary to adjust respectively the current to two or more above-mentioned semi-conductor light emitting devices, there is a problem that semi-conductor luminescence equipment becomes complicated. Moreover, when a luminescence display is formed using the above-mentioned semi-conductor luminescence equipment two or more, there is a trouble that adjustment of the color tone of the semi-conductor light emitting device of a large quantity is needed, and a production process becomes complicated.

[0011] Moreover, since the semi-conductor luminescence equipment currently indicated by the above-mentioned patent No. 2927279 and JP,10-163535,A carried out color mixture of the outgoing radiation light of a semi-conductor light emitting device, and this outgoing radiation light and the luminescence light of the fluorescent substance which has the relation of the complementary color and obtained the white luminescent color, it had the trouble that a color tone was not good, either, bad [the utilization effectiveness of light]. For example, when the semi-conductor luminescence equipment which acquires the white light with the color mixture of a blue outgoing radiation light of a semi-conductor light emitting device and the outgoing radiation light of the yellow of a fluorescent substance is used as a back light of a liquid crystal display, since there is little quantity of light of pure red and there are few amounts of the light which penetrates the red light filter with which the above-mentioned liquid crystal display is equipped, this white light has green pure and the trouble of giving an impression which carried out the color omission, when the above-mentioned liquid crystal display indicates by full color.

[0012] Moreover, since the semi-conductor luminescence equipment currently indicated by JP,10-12925,A impresses a pulse-like high current to a semi-conductor light emitting device, a semi-conductor light emitting device breaks, or it generates heat, and it deteriorates, and has the trouble that a life is short and it is unreliable. Moreover, since the above-mentioned semi-conductor light emitting device has the peak of luminescence wavelength also on blue wavelength while having the peak of luminescence wavelength on ultraviolet and near-ultraviolet wavelength, this blue glow carries out color mixture of it to the luminescence light of fluorescence, and it has the problem that a color tone is bad. Furthermore, since brightness does not deteriorate [the semi-conductor light emitting device which has the luminescent color from which plurality differs] uniformly and a blue wavelength component falls rapidly especially when semi-conductor luminescence equipment deteriorates, there is a trouble that the color tone of semi-conductor luminescence equipment will change. Furthermore, since the above-mentioned semi-conductor light emitting device carries out outgoing radiation of the light of the wavelength of the ultraviolet region by the side of short wavelength from near near-ultraviolet (390nm), the measure which prevents the effect on the body is required for it. Moreover, since the object for immobilization of the above-mentioned semi-conductor light emitting device and the resin for moulds also receive an adverse effect by the light of the wavelength of the above-mentioned ultraviolet region, they have the trouble that there is a possibility of causing lowering of the dependability by deterioration of the above-mentioned resin for immobilization and lowering of the luminescence brightness by the melanism of the above-mentioned resin for moulds.

[0013] While the semi-conductor luminescence equipment indicated by publication number No. 153644 [nine to] also needs to enforce the leakage control of the light of an ultraviolet region in order to prevent the effect on the body since it uses the luminescence wavelength of the ultraviolet region of 380nm, it has the trouble that the object for immobilization of a semi-conductor light emitting device and the resin for moulds cause lowering of dependability, and lowering of luminescence brightness in response to an adverse effect. Furthermore, this semi-conductor luminescence equipment has the trouble that the production process of semi-conductor luminescence equipment is complicated, and the yield and dependability fall on a substrate since red, blue, and the fluorescent substance layer that emits light in the green three primary colors are formed with a semi-conductor layer.

[0014] In spite of being made in order to solve the above-mentioned technical problem, and being able to carry out the outgoing radiation of the light of two or more luminescence wavelength, manufacture is easy and cheap, a color tone is good, there is little effect on the body, and this invention aims at offering the semi-conductor luminescence equipment which does not almost have degradation, and the luminescence display using it.

[0015]

[Means for Solving the Problem] In the semi-conductor luminescence equipment with which the semi-conductor luminescence equipment of this invention comes to carry a semi-conductor light emitting device on a base in order to attain the above-mentioned object, the above-mentioned semi-conductor light emitting device is characterized by to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 600nm thru/or 670nm with the fluorescent substance which carries out the outgoing radiation of the red light which has the main luminescence peak.

[0016] According to this invention, in the above-mentioned semi-conductor luminescence equipment, the above-mentioned semi-conductor light emitting device has upwards the outgoing radiation light of the short wavelength field where human being's visibility is very low, and the above-mentioned fluorescent substance Since luminescence wavelength has the main luminescence peak to a red wavelength field and carries out outgoing radiation of the light of monochromatic red Even if the light and a direct outgoing radiation light from the above-mentioned semi-conductor light emitting device the above-mentioned fluorescent substance carries out [light] outgoing radiation

are mixed, if human being's visibility is taken into consideration, the color tone of the outgoing radiation light of the above-mentioned fluorescent substance will hardly change seemingly. That is, outgoing radiation of the light from the above-mentioned fluorescent substance is carried out from semi-conductor luminescence equipment, without being influenced of the direct light from the above-mentioned semi-conductor light emitting device. Therefore, the semi-conductor luminescence equipment of monochrome red luminescence with a good color tone is obtained.

[0017] Moreover, in the above-mentioned semi-conductor luminescence equipment, since the above-mentioned semi-conductor light emitting device has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, it cannot damage the component part of semi-conductor luminescence equipments, such as closure resin, easily, for example, and does not almost have an operation harmful to the body. If the luminescence wavelength of a semi-conductor light emitting device is shorter than 390nm, the above-mentioned closure resin is damaged, for example, and inconvenience, such as opacification and melanism, may be produced. On the other hand, if the luminescence wavelength of the above-mentioned semi-conductor light emitting device is longer than 420nm, since the outgoing radiation light from this semi-conductor light emitting device comes to have the luminescence wavelength of a visible region, it will carry out color mixture to the outgoing radiation light from the above-mentioned fluorescent substance, and the color tone of the luminescent color of semi-conductor luminescence equipment will change. Therefore, by setting luminescence wavelength of the above-mentioned semi-conductor light emitting device to 390nm thru/or 420nm, degradation of the component part of semi-conductor luminescence equipment can be lessened, and there is almost no adverse effect in the body, and, moreover, semi-conductor luminescence equipment with a good color tone is obtained.

[0018] in the semi-conductor luminescence equipment of 1 operation gestalt, the above-mentioned fluorescent substance consists of any one or 2 or more M2O2 S:Eu (however, any one or two or more elements with which M is chosen from La, Gd, and Y), 0.5MgF2 and 3.5 MgO-GeO2:Mn, Y2O3:Eu, Y(P, V) O4:Eu, YVO4:Eu, and among the groups of a fluorescent substance come out of and expressed.

[0019] Since according to the above-mentioned operation gestalt the above-mentioned fluorescent substance can be chosen according to the wavelength of the outgoing radiation light of the above-mentioned semi-conductor light emitting device even if it uses the semi-conductor light emitting device which has which outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, the semi-conductor luminescence equipment of monochrome red luminescence with which luminescence wavelength has a good luminescence peak to a red wavelength field is obtained. Moreover, since the wavelength of all abbreviation for the wavelength field of the outgoing radiation light of a semi-conductor light emitting device is convertible for red wavelength by combining two or more fluorescent substances, the semi-conductor luminescence equipment of efficient monochrome red luminescence is obtained.

[0020] In the semi-conductor luminescence equipment with which the semi-conductor luminescence equipment of this invention comes to carry a semi-conductor light emitting device on a base, the above-mentioned semi-conductor light emitting device is characterized by to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 500nm thru/or 540nm with the fluorescent substance which carries out outgoing radiation of the green light which has the main luminescence peak.

[0021] According to this invention, in the above-mentioned semi-conductor luminescence equipment, the above-mentioned semi-conductor light emitting device has upwards the outgoing radiation light of the short wavelength field where human being's visibility is very low, and the above-mentioned fluorescent substance Since luminescence wavelength has the main luminescence peak to a green wavelength field and carries out outgoing radiation of the monochromatic green light Even if the light and a direct outgoing radiation light from the above-mentioned semi-conductor light emitting device the above-mentioned fluorescent substance carries out [light] outgoing radiation are mixed, if human being's visibility is taken into consideration, the color tone of the outgoing radiation light of the above-mentioned fluorescent substance will hardly change seemingly. That is, outgoing radiation of the light from the above-mentioned fluorescent substance is carried out from semi-conductor luminescence equipment, without being influenced of the direct light from the above-mentioned semi-conductor light emitting device. Therefore, the semi-conductor luminescence equipment of monochrome green luminescence with a good color tone is obtained.

[0022] Moreover, in the above-mentioned semi-conductor luminescence equipment, since the above-mentioned semi-conductor light emitting device has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, it cannot damage the component part of semi-conductor luminescence equipments, such as closure resin, easily, for example, and does not almost have an operation harmful to the body. If the luminescence wavelength of a semi-conductor light emitting device is shorter than 390nm, the above-mentioned closure resin is damaged, for example, and inconvenience, such as opacification and melanism, may be produced. On the other hand, if the luminescence wavelength of the above-mentioned semi-conductor light emitting device is longer than 420nm, since the outgoing radiation light from this semi-conductor light emitting device comes to have the luminescence wavelength of a visible region, it will carry out color mixture to the outgoing radiation light from the above-mentioned fluorescent substance, and the color tone of the luminescent color of semi-conductor luminescence equipment will change. Therefore, by setting luminescence wavelength of the above-mentioned semi-conductor light emitting device to 390nm thru/or 420nm, degradation of the component part of semi-conductor luminescence equipment can be lessened, and there is almost no adverse effect in the body, and, moreover, semi-conductor luminescence equipment with a good color tone is obtained.

[0023] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance RMg2aluminum16O27: — Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) — RMgAl10O17: — Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) — It Eu(s) and D(ies). ZnS:Cu, SrAl2O4:Eu, and SrAl2O4: — ZnO:Zn, Zn2germanium2O4:Mn, Zn2SiO4:Mn, and Q3MgSi2O8: — it consists of any one or 2 or more Eu, Mn (however, any one or two or more elements with which Q is chosen from Sr, Ba, and calcium), and among the groups of a fluorescent substance come out of and expressed.
[0024] According to the above-mentioned operation gestalt, since the optimal fluorescent substance can be chosen according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of monochrome green luminescence which has a good luminescence peak to the wavelength field where luminescence wavelength is green is obtained. Moreover, since the wavelength of all abbreviation for the wavelength field of the outgoing radiation light of a semi-conductor light emitting device is convertible for green wavelength by combining two or more fluorescent substances, the semi-conductor luminescence equipment of efficient monochrome green luminescence is obtained.
[0025] In the semi-conductor luminescence equipment with which the semi-conductor luminescence equipment of this invention comes to carry a semi-conductor light emitting device on a base, the above-mentioned semi-conductor light emitting device is characterized by to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 410nm thru/or 480nm with the fluorescent substance which carries out outgoing radiation of the blue light which has the main luminescence peak.
[0026] According to this invention, in the above-mentioned semi-conductor luminescence equipment, the above-mentioned semi-conductor light emitting device has upwards the outgoing radiation light of the short wavelength field where human being's visibility is very low, and the above-mentioned fluorescent substance Since luminescence wavelength has the main luminescence peak to a blue wavelength field and carries out outgoing radiation of the monochromatic blue light Even if the light and a direct outgoing radiation light from the above-mentioned semi-conductor light emitting device the above-mentioned fluorescent substance carries out [light] outgoing radiation are mixed, if human being's visibility is taken into consideration, the color tone of the outgoing radiation light of the above-mentioned fluorescent substance will hardly change seemingly. That is, outgoing radiation of the light from the above-mentioned fluorescent substance is carried out from semi-conductor luminescence equipment, without being influenced of the direct light from the above-mentioned semi-conductor light emitting device. Therefore, the semi-conductor luminescence equipment of monochrome blue luminescence with a good color tone is obtained.
[0027] Moreover, in the above-mentioned semi-conductor luminescence equipment, since the above-mentioned semi-conductor light emitting device has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, it cannot damage the component part of semi-conductor luminescence equipments, such as closure resin, easily, for example, and does not almost have an operation harmful to the body. If the luminescence wavelength of a semi-conductor light emitting device is shorter than 390nm, the above-mentioned closure resin is damaged, for example, and inconvenience, such as opacification and melanism, may be produced. On the other hand, if the luminescence wavelength of the above-mentioned semi-conductor light emitting device is longer than 420nm, since the outgoing radiation light from this semi-conductor light emitting device comes to have the luminescence wavelength of a visible region, it will carry out color mixture to the outgoing radiation light from the above-mentioned fluorescent substance, and the color tone of the luminescent color of semi-conductor luminescence equipment will change. Therefore, by setting luminescence wavelength of the above-mentioned semi-conductor light emitting device to 390nm thru/or 420nm, degradation of the component part of semi-conductor luminescence equipment can be lessened, and there is almost no adverse effect in the body, and, moreover, semi-conductor luminescence equipment with a good color tone is obtained.
[0028] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance A10(PO4) 6Cl2:Eu (however, any one or two or more elements with which A is chosen from Sr, calcium, Ba, Mg, and Ce), XMg2aluminum16O27:Eu (however, any one as which X is chosen from Sr and Ba or both elements), XMgAl10O17:Eu (however, any one as which X is chosen from Sr and Ba or both elements), ZnS:Ag, Sr10(PO4) 6Cl2:Eu, calcium10(PO4) 6F2:Sb, Z3MgSi2O8:Eu (however, any one or two or more elements with which Z is chosen from Sr, Ba, and calcium), SrMgSi2O8:Eu, Sr2P2O7:Eu, and CaAl2O4: — it consists of any one or 2 or more Eu, Nd, and among the groups of a fluorescent substance come out of and expressed.
[0029] According to the above-mentioned operation gestalt, since the optimal fluorescent substance can be chosen according to the luminescence wavelength of a semi-conductor light emitting device, the semi-conductor luminescence equipment of monochrome blue luminescence which has a good luminescence peak to the wavelength field where luminescence wavelength is blue is obtained. Moreover, since the wavelength of all abbreviation for the wavelength field of the outgoing radiation light of the above-mentioned semi-conductor light emitting device is convertible for blue wavelength by combining two or more fluorescent substances, the semi-conductor luminescence equipment of efficient monochrome blue luminescence is obtained.
[0030] In the semi-conductor luminescence equipment with which the semi-conductor luminescence equipment of this invention comes to carry a semi-conductor light emitting device on a base, the above-mentioned semi-conductor light emitting device is characterized by to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 480nm thru/or

500nm with the fluorescent substance which carries out outgoing radiation of the light of a bluish-green color which has the main luminescence peak.

[0031] According to this invention, in the above-mentioned semi-conductor luminescence equipment, the above-mentioned semi-conductor light emitting device has upwards the outgoing radiation light of the short wavelength field where human being's visibility is very low, and the above-mentioned fluorescent substance Since luminescence wavelength has the main luminescence peak to the wavelength field of a bluish green color and carries out outgoing radiation of the light of a monochromatic bluish green color Even if the light and a direct outgoing radiation light from the above-mentioned semi-conductor light emitting device the above-mentioned fluorescent substance carries out [light] outgoing radiation are mixed, if human being's visibility is taken into consideration, the color tone of the outgoing radiation light of the above-mentioned fluorescent substance will hardly change seemingly. That is, outgoing radiation of the light from the above-mentioned fluorescent substance is carried out from semi-conductor luminescence equipment, without being influenced of the direct light from the above-mentioned semi-conductor light emitting device. Therefore, the semi-conductor luminescence equipment of monochrome bluish green color luminescence with a good color tone is obtained.

[0032] Moreover, in the above-mentioned semi-conductor luminescence equipment, since the above-mentioned semi-conductor light emitting device has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, it cannot damage the component part of semi-conductor luminescence equipments, such as closure resin, easily, for example, and does not almost have an operation harmful to the body. If the luminescence wavelength of a semi-conductor light emitting device is shorter than 390nm, the above-mentioned closure resin is damaged, for example, and inconvenience, such as opacification and melanism, may be produced. On the other hand, if the luminescence wavelength of the above-mentioned semi-conductor light emitting device is longer than 420nm, since the outgoing radiation light from this semi-conductor light emitting device comes to have the luminescence wavelength of a visible region, it will carry out color mixture to the outgoing radiation light from the above-mentioned fluorescent substance, and the color tone of the luminescent color of semi-conductor luminescence equipment will change. Therefore, by setting luminescence wavelength of the above-mentioned semi-conductor light emitting device to 390nm thru/or 420nm, degradation of the component part of semi-conductor luminescence equipment can be lessened, and there is almost no adverse effect in the body, and, moreover, semi-conductor luminescence equipment with a good color tone is obtained.

[0033] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance It Eu(s) and D(ies). Sr4aluminum14O25:Eu and Sr4aluminum14O25: — it consists of any one or 2 or more L10(PO4) 6Cl2:Eu (however, any one or two or more elements with which L is chosen from Ba, calcium, and Mg), Sr2Si3O8 and 2SrCl2:Eu, and among the groups of a fluorescent substance come out of and expressed.

[0034] According to the above-mentioned operation gestalt, since the optimal fluorescent substance can be chosen according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of monochrome bluish green color luminescence with which luminescence wavelength has a good luminescence peak to the wavelength field of a bluish green color is obtained. Moreover, since the wavelength of all abbreviation for the wavelength field of light in which the above-mentioned semi-conductor light emitting device carries out outgoing radiation by combining two or more fluorescent substances is convertible for the wavelength of a bluish green color, the semi-conductor luminescence equipment of efficient monochrome bluish green color luminescence is obtained.

[0035] In the semi-conductor luminescence equipment with which the semi-conductor luminescence equipment of this invention comes to carry a semi-conductor light emitting device on a base, the above-mentioned semi-conductor light emitting device is characterized by to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 570nm thru/or 600nm with the fluorescent substance which carries out outgoing radiation of the orange light which has the main luminescence peak.

[0036] According to this invention, in the above-mentioned semi-conductor luminescence equipment, the above-mentioned semi-conductor light emitting device has upwards the outgoing radiation light of the short wavelength field where human being's visibility is very low, and the above-mentioned fluorescent substance Since luminescence wavelength has the main luminescence peak to an orange wavelength field and carries out outgoing radiation of the monochromatic orange light Even if the light and a direct outgoing radiation light from the above-mentioned semi-conductor light emitting device the above-mentioned fluorescent substance carries out [light] outgoing radiation are mixed, if human being's visibility is taken into consideration, the color tone of the outgoing radiation light of the above-mentioned fluorescent substance will hardly change seemingly. That is, outgoing radiation of the light from the above-mentioned fluorescent substance is carried out from semi-conductor luminescence equipment, without being influenced of the direct light from the above-mentioned semi-conductor light emitting device. Therefore, the semi-conductor luminescence equipment of monochrome orange light emitting with a good color tone is obtained.

[0037] Moreover, in the above-mentioned semi-conductor luminescence equipment, since the above-mentioned semi-conductor light emitting device has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, it cannot damage the component part of semi-conductor luminescence equipments, such as closure resin, easily, for example, and does not almost have an operation harmful to the body. If the luminescence wavelength of a semi-conductor light emitting device is shorter than 390nm, the above-mentioned closure resin is damaged, for example, and inconvenience, such as opacification and melanism, may be produced. On the other hand,

if the luminescence wavelength of the above-mentioned semi-conductor light emitting device is longer than 420nm, since the outgoing radiation light from this semi-conductor light emitting device comes to have the luminescence wavelength of a visible region, it will carry out color mixture to the outgoing radiation light from the above-mentioned fluorescent substance, and the color tone of the luminescent color of semi-conductor luminescence equipment will change. Therefore, by setting luminescence wavelength of the above-mentioned semi-conductor light emitting device to 390nm thru/or 420nm, degradation of the component part of semi-conductor luminescence equipment can be lessened, and there is almost no adverse effect in the body, and, moreover, semi-conductor luminescence equipment with a good color tone is obtained.

[0038] In the semi-conductor luminescence equipment of 1 operation gestalt, the above-mentioned fluorescent substance consists of any one or 2 or more ZnS:Mn, ZnS:Cu, Mn and Co, and among the groups of a fluorescent substance come out of and expressed.

[0039] According to the above-mentioned operation gestalt, since the optimal fluorescent substance can be chosen according to the wavelength field of a semi-conductor light emitting device, luminescence wavelength can obtain the semi-conductor luminescence equipment of the monochrome orange light emitting which has the main luminescence peak to an orange luminescence wavelength field.

[0040] The semi-conductor luminescence equipment of 1 operation gestalt is equipped with the closure resin which closes at least the part and the above-mentioned semi-conductor light emitting device of the above-mentioned base, and the above-mentioned closure resin contains the above-mentioned fluorescent substance.

[0041] Since the closure resin which closes the above-mentioned semi-conductor light emitting device contains the fluorescent substance according to the above-mentioned operation gestalt, since wavelength conversion is surely carried out, the outgoing radiation light from a semi-conductor light emitting device has the good utilization effectiveness of the light of a semi-conductor light emitting device. Moreover, since a fluorescent substance can be arranged while forming closure resin and the process which arranges a fluorescent substance separately is unnecessary, manufacture of semi-conductor luminescence equipment becomes easy.

[0042] Moreover, the semiconductor device which has desired luminescence wavelength is obtained, without changing the structure of a semi-conductor light emitting device and semi-conductor luminescence equipment, when this semi-conductor luminescence equipment combines the semi-conductor light emitting device which has the wavelength field where luminescence wavelength is fixed, and a predetermined fluorescent substance. That is, by the same production process, since the semi-conductor luminescence luminescence equipment which has desired luminescence wavelength is obtained, the manufacturing cost of semi-conductor luminescence equipment is substantially reducible only only changing a fluorescent substance.

[0043] The semi-conductor luminescence equipment of 1 operation gestalt is a leadframe in which the above-mentioned base has the mounting section of a cup configuration, the above-mentioned semi-conductor light emitting device is arranged at the bottom of the mounting section of the cup configuration of the above-mentioned leadframe, and wire bonding connects with another leadframe electrically, and at least the part and the above-mentioned semi-conductor light emitting device of the two above-mentioned leadframes are closed by the above-mentioned closure resin.

[0044] Since wavelength conversion of the outgoing radiation light from the above-mentioned semi-conductor light emitting device collected by the mounting section of the above-mentioned cup configuration is certainly carried out with the closure resin containing the above-mentioned fluorescent substance according to the above-mentioned operation gestalt, semi-conductor luminescence equipment with a color tone good luminous efficiency and sufficient is obtained with sufficient directivity.

[0045] The semi-conductor luminescence equipment of 1 operation gestalt is the insulator with which the above-mentioned base was connected at the head of the leadframe of a couple, the above-mentioned semi-conductor light emitting device is connected to metal wiring formed in the above-mentioned insulator, and at least the part, the above-mentioned insulator, and the above-mentioned semi-conductor light emitting device of a leadframe of a up Norikazu pair are closed by the above-mentioned closure resin.

[0046] According to the above-mentioned operation gestalt, since direct continuation of the above-mentioned semi-conductor light emitting device is carried out to metal wiring of the above-mentioned substrate for example, by a metal bump etc., the time and effort which connects a semi-conductor light emitting device and a leadframe with a metal wire etc. is saved. Moreover, wavelength conversion of the outgoing radiation light from a semi-conductor light emitting device is certainly carried out with the fluorescent substance contained in the above-mentioned closure resin. Therefore, manufacture effectiveness is good and, moreover, semi-conductor luminescence equipment with a color tone good luminous efficiency and sufficient is obtained.

[0047] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned base It is the leadframe which has the mounting section of a cup configuration. The above-mentioned semi-conductor light emitting device It is arranged at the bottom of the mounting section of the cup configuration of the above-mentioned leadframe. And while wire bonding connects with another leadframe electrically and the mounting section of the above-mentioned cup configuration is filled up with the above-mentioned fluorescent substance At least the part, the above-mentioned semi-conductor light emitting device, and the above-mentioned fluorescent substance of the two above-mentioned leadframes are closed by closure resin.

[0048] Since the mounting section of the cup configuration for which the light from the above-mentioned semi-conductor light emitting device gathers is filled up with a fluorescent substance according to the above-mentioned operation gestalt, wavelength conversion is carried out certainly and the utilization effectiveness of light from a

semi-conductor light emitting device of light improves. Moreover, since the field which arranges a fluorescent substance is small as compared with the semi-conductor luminescence equipment which does not collect the light from a semi-conductor light emitting device, the amount of the above-mentioned fluorescent substance used can be lessened.

[0049] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned base It is the leadframe which has the mounting section of a cup configuration. The above-mentioned semi-conductor light emitting device It is arranged at the bottom of the mounting section of the cup configuration of the above-mentioned leadframe. And while wire bonding connects with another leadframe electrically, filling up the mounting section of the above-mentioned cup configuration with a coating member and arranging the above-mentioned fluorescent substance on the above-mentioned coating member At least the part, the above-mentioned semi-conductor light emitting device, the above-mentioned coating member, and the above-mentioned fluorescent substance of the two above-mentioned leadframes are closed by closure resin.

[0050] Since the above-mentioned fluorescent substance is arranged on the coating member filled up by the above-mentioned mounting section according to the above-mentioned operation gestalt, compared with the case where all the above-mentioned mounting circles are filled up with a fluorescent substance, the amount of the above-mentioned fluorescent substance used is reduced. Moreover, by the above-mentioned coating member, since the distance between the light-emitting part of the above-mentioned semi-conductor light emitting device and a fluorescent substance becomes abbreviation homogeneity, the semi-conductor luminescence equipment of homogeneity luminescence without an irregular color is obtained. Furthermore, since the above-mentioned semi-conductor light emitting device and a fluorescent substance are estranged by the above-mentioned coating member, there is almost no electric and thermal degradation of the fluorescent substance by the semi-conductor light emitting device.

[0051] The above-mentioned base is the substrate with which metal wiring was given, the above-mentioned semi-conductor light emitting device is electrically connected to metal wiring of the above-mentioned substrate, the semi-conductor luminescence equipment of 1 operation gestalt is equipped with the closure resin which closes the above-mentioned semi-conductor light emitting device, and the above-mentioned closure resin contains the above-mentioned fluorescent substance.

[0052] According to the above-mentioned operation gestalt, direct continuation of the above-mentioned semi-conductor light emitting device is done by the metal bump etc., without using metal wires, such as Au, and aluminum, Cu, for the semi-conductor light emitting device of the same configuration or a single class, connecting on metal wiring or using a metal wire etc. for the above-mentioned substrate. Therefore, the manufacture process of semi-conductor luminescence equipment is easy rather than it manufactures the semi-conductor luminescence equipment of a different configuration using the semi-conductor light emitting device of a different configuration [as / in the former] corresponding to the luminescent color. In this semi-conductor luminescence equipment, since the semi-conductor luminescence equipment which has desired luminescence wavelength only by arranging the predetermined fluorescent substance corresponding to desired wavelength is obtained, compared with the former, manufacture of semi-conductor luminescence equipment becomes simplicity and low cost.

[0053] The semi-conductor luminescence equipment of 1 operation gestalt is arranged in the crevice while the above-mentioned base is the substrate with which metal wiring was given and is connected electrically [the above-mentioned semi-conductor light emitting device] to metal wiring of the above-mentioned substrate, and it fills up with the above-mentioned fluorescent substance in the above-mentioned crevice.

[0054] According to the above-mentioned operation gestalt, since the crevice of the above-mentioned substrate is filled up with the above-mentioned fluorescent substance, the amount of this fluorescent substance used becomes little, a manufacturing cost is cheap, luminous efficiency is good, and, moreover, semi-conductor luminescence equipment with a sufficient color tone is obtained by monochrome luminescence.

[0055] The semi-conductor luminescence equipment of 1 operation gestalt is formed with the frame with which the above-mentioned crevice has been arranged at the above-mentioned substrate.

[0056] Since according to the above-mentioned operation gestalt a frame is arranged to the above-mentioned substrate and the above-mentioned crevice is formed, the time and effort of processing which cuts a substrate, for example and forms a crevice is reduced. Moreover, in the configuration of the side face for example, by the side of the above-mentioned semi-conductor light emitting device, by processing the outgoing radiation light from the above-mentioned semi-conductor light emitting device into the condensing configuration, while the conversion efficiency of the wavelength of the above-mentioned outgoing radiation light improves further, the directivity of semi-conductor luminescence equipment improves the above-mentioned frame. Consequently, luminous efficiency is good and, moreover, semi-conductor luminescence equipment with a sufficient color tone is obtained by monochrome luminescence.

[0057] While in the semi-conductor luminescence equipment of 1 operation gestalt it is the given substrate, metal wiring is arranged in the crevice while the above-mentioned semi-conductor light emitting device is electrically connected to metal wiring of the above-mentioned substrate, and the above-mentioned base fills up the above-mentioned crevice with closure resin, the above-mentioned fluorescent substance is arranged on the above-mentioned closure resin.

[0058] According to the above-mentioned operation gestalt, since the above-mentioned fluorescent substance is arranged on the above-mentioned closure resin, the semi-conductor luminescence equipment which has desired luminescence wavelength is obtained by the amount of the still more nearly little fluorescent substance used rather

than it is filled up with a fluorescent substance inside the crevice of the above-mentioned substrate. Moreover, with the above-mentioned closure resin, since the distance between the light-emitting part of a semi-conductor light emitting device and a fluorescent substance becomes abbreviation homogeneity, the semi-conductor luminescence equipment of homogeneity luminescence which does not almost have an irregular color is obtained. Moreover, since the above-mentioned closure resin makes a high order semi-conductor light emitting device and a fluorescent substance estrange, it can reduce the electric and thermal effect of a semi-conductor light emitting device to the above-mentioned fluorescent substance, and its engine performance of semi-conductor luminescence equipment is stable.

[0059] It is connected with metal wiring and the electric target of the above-mentioned substrate, and the above-mentioned semi-conductor light emitting device is equipped with the reflector which reflects a part of outgoing-radiation light [at least] from the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of 1 operation gestalt is the substrate with which, as for the above-mentioned base, metal wiring was given, while closing the above-mentioned semi-conductor light emitting device, it has closure resin which the reflected light from the above-mentioned reflector penetrates, and the above-mentioned fluorescent substance is contained in the above-mentioned closure resin.

[0060] According to the above-mentioned operation gestalt, direct continuation of the above-mentioned semi-conductor light emitting device is done by the metal bump etc., without using metal wires, such as Au, and aluminum, Cu, for the semi-conductor light emitting device of the same configuration or a single class, connecting on metal wiring or using a metal wire etc. for the above-mentioned substrate. Therefore, the manufacture process of semi-conductor luminescence equipment is easy rather than it manufactures the semi-conductor luminescence equipment of a different configuration using the semi-conductor light emitting device of a different configuration [as / in the former] corresponding to the luminescent color. In this semi-conductor luminescence equipment, since the semi-conductor luminescence equipment which has desired luminescence wavelength only by arranging the predetermined fluorescent substance corresponding to desired wavelength is obtained, compared with the former, manufacture of semi-conductor luminescence equipment becomes simplicity and low cost.

[0061] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned base It is the substrate with which metal wiring was given. The above-mentioned semi-conductor light emitting device Connect with the above-mentioned metal wiring and the electric target of the above-mentioned substrate, and it has the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device. The exterior of semi-conductor luminescence equipment is equipped with the screen which interrupts the light which carries out direct outgoing radiation from the above-mentioned semi-conductor light emitting device, while closing the above-mentioned semi-conductor light emitting device, it has closure resin which the reflected light from the above-mentioned reflector penetrates, and the layer of the above-mentioned fluorescent substance is prepared in the field which light reflects in the above-mentioned reflector.

[0062] Since the layer of the above-mentioned fluorescent substance is prepared in the field which light reflects in the above-mentioned reflector according to the above-mentioned operation gestalt, wavelength conversion of the light reflected by this reflector is carried out certainly. And since it is reflected in the above-mentioned reflector and outgoing radiation of the outgoing radiation light from the above-mentioned semi-conductor light emitting device is carried out to the semi-conductor luminescence equipment exterior, without leaking to the exterior of semi-conductor luminescence equipment by the above-mentioned screen, they is the light by which wavelength conversion of all was carried out. [most] Therefore, this semi-conductor luminescence equipment is formed only in a reflector, it is the amount of few fluorescent substances used, and the desired luminescent color is obtained efficiently. Furthermore, since the layer of the above-mentioned fluorescent substance is formed in the reflector of the reflector which makes a predetermined distance from a semi-conductor light emitting device, the distance between the light-emitting part of a semi-conductor light emitting device and a fluorescent substance becomes abbreviation homogeneity, and the semi-conductor luminescence equipment of homogeneity luminescence without an irregular color is obtained. Furthermore, since a semi-conductor light emitting device and a fluorescent substance are estranged, the electric and thermal effect of a semi-conductor light emitting device to a fluorescent substance is eased, and the engine performance of semi-conductor luminescence equipment is stabilized.

[0063] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned base It is the substrate with which metal wiring was given. The above-mentioned semi-conductor light emitting device Connect with the above-mentioned metal wiring and the electric target of the above-mentioned substrate, and a part for the light-emitting part of the above-mentioned semi-conductor light emitting device is arranged in the crevice of the above-mentioned substrate at least. It has the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device, while closing the above-mentioned semi-conductor light emitting device, it has closure resin which the reflected light from the above-mentioned reflector penetrates, and the layer of the above-mentioned fluorescent substance is prepared in the field which light reflects in the above-mentioned reflector.

[0064] According to the above-mentioned operation gestalt, since the semi-conductor light emitting device is arranged in the above-mentioned crevice, after wavelength conversion is surely reflected and carried out by the above-mentioned reflector in the exterior of semi-conductor luminescence equipment, without carrying out direct outgoing radiation, outgoing radiation of the light from a semi-conductor light emitting device is carried out to the exterior of semi-conductor luminescence equipment. Therefore, as for this semi-conductor luminescence equipment, the color tone of outgoing radiation light becomes good.

[0065] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned base It is the substrate with which metal wiring was given. The above-mentioned semi-conductor light emitting device Connect with the above-mentioned metal wiring and the electric target of the above-mentioned substrate, and it has the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device. While closing the above-mentioned semi-conductor light emitting device, it has closure resin which the reflected light from the above-mentioned reflector penetrates, and the layer of the above-mentioned fluorescent substance is prepared in the field as for which the light of the above-mentioned closure resin carries out outgoing radiation.

[0066] According to the above-mentioned operation gestalt, just before outgoing radiation is carried out from semi-conductor luminescence equipment, wavelength conversion of the outgoing radiation light from a semi-conductor light emitting device is carried out by the layer of the fluorescent substance prepared in the field as for which the light of the above-mentioned closure resin carries out outgoing radiation. That is, since wavelength conversion of all the light from this semi-conductor luminescence equipment is carried out, it becomes semi-conductor luminescence equipment of the utilization effectiveness of a good light. Moreover, since the layer of the above-mentioned fluorescent substance is in the location which kept a predetermined distance from the semi-conductor light emitting device, the distance between the light-emitting part of a semi-conductor light emitting device and a fluorescent substance becomes abbreviation homogeneity, and the semi-conductor luminescence equipment of homogeneity luminescence without an irregular color is obtained. Furthermore, since a semi-conductor light emitting device and a fluorescent substance are estranged, the electric and thermal effect of a semi-conductor light emitting device to a fluorescent substance is eased, and the engine performance of semi-conductor luminescence equipment is stabilized.

[0067] In the semi-conductor luminescence equipment with which the semi-conductor luminescence equipment of this invention comes to carry a semi-conductor light emitting device on a base the above-mentioned semi-conductor light emitting device It has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, and has the 1st fluorescent substance, the 2nd fluorescent substance, and the 3rd fluorescent substance. The 1st fluorescent substance of the above It has a red outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 600nm thru/or 670nm. The 2nd fluorescent substance of the above It has a green outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 500nm thru/or 540nm. The 3rd fluorescent substance of the above It has a blue outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 410nm thru/or 480nm, and the sum of the color of the outgoing radiation style from the 1st, 2nd, and 3rd fluorescent substance of the above is characterized by being a white system.

[0068] According to the above-mentioned configuration, the light in which the above-mentioned semi-conductor light emitting device has upwards the short wavelength field where human being's visibility is very low, and the above 1st thru/or the 3rd fluorescent substance carry out outgoing radiation Since it is the light of red, green, and the monochrome that has the main peak of luminescence wavelength respectively to a blue wavelength field Even if the above 1st thru/or the outgoing radiation light from the 3rd fluorescent substance and a direct outgoing radiation light from the above-mentioned semi-conductor light emitting device are mixed, if human being's visibility is taken into consideration, the color tone of the outgoing radiation light of semi-conductor luminescence equipment will hardly change seemingly. That is, the above 1st thru/or the light from which [3rd] fluorescent substance are not influenced of the direct light from the above-mentioned semi-conductor light emitting device, either. Therefore, the semi-conductor luminescence equipment with which a color tone has the luminescent color of a good white system is obtained. Moreover, since color mixture is not carried out to the light from a fluorescent substance in human being's visible region, even if, as for the light by which direct outgoing radiation is carried out to the semi-conductor luminescence equipment exterior from a semi-conductor light emitting device about the outgoing radiation light of semi-conductor luminescence equipment, the luminescence engine performance of a semi-conductor light emitting device falls according to secular change after the activity of the long duration of semi-conductor luminescence equipment, it is only that the brightness of semi-conductor luminescence equipment falls, and a color tone does not change. Therefore, the light of a white system with a good color tone is stabilized by the above-mentioned semi-conductor luminescence equipment, and it is obtained.

[0069] Moreover, in the above-mentioned semi-conductor luminescence equipment, since the above-mentioned semi-conductor light emitting device has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, it cannot damage the component part of semi-conductor luminescence equipments, such as closure resin, easily, for example, and does not almost have an operation harmful to the body. If the luminescence wavelength of a semi-conductor light emitting device is shorter than 390nm, the above-mentioned closure resin is damaged, for example, and inconvenience, such as opacification and melanism, may be produced. Therefore, by setting luminescence wavelength of the above-mentioned semi-conductor light emitting device to 390nm thru/or 420nm, degradation of the component part of semi-conductor luminescence equipment can be lessened, and there is almost no adverse effect in the body, and, moreover, semi-conductor luminescence equipment with a good color tone is obtained.

[0070] The semi-conductor luminescence equipment of 1 operation gestalt the 1st fluorescent substance of the above M2O2 S:Eu (however, any one or two or more elements with which M is chosen from La, Gd, and Y), 0.5MgF2 and 3.5 MgO-GeO2:Mn, Y2O3:Eu, It consists of any one or 2 or more Y(P, V) O4:Eu, YVO4:Eu, and among the groups of a fluorescent substance come out of and expressed. the 2nd fluorescent substance of the above

RMg2aluminum16O27: — Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) — RMgAl10O17: — Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) — It Eu(s) and D(ies). ZnS:Cu, SrAl2O4:Eu, and SrAl2O4: — ZnO:Zn, Zn2germanium2O4:Mn, Zn2SiO4:Mn, and Q3MgSi2O8:Eu - - Mn It consists of any one or 2 or more however, (any one or two or more elements) with which Q is chosen from Sr, Ba, and calcium, and among the groups of a fluorescent substance come out of and expressed. the 3rd fluorescent substance of the above A10(PO4) 6Cl2:Eu (however, any one or two or more elements with which A is chosen from Sr, calcium, Ba, Mg, and Ce), XMg2aluminum16O27:Eu (however, any one as which X is chosen from Sr and Ba or both elements), XMgAl10O17:Eu (however, any one as which X is chosen from Sr and Ba or both elements), ZnS:Ag, Sr10(PO4) 6Cl2:Eu, calcium10(PO4) 6F2:Sb, Z3MgSi2O8:Eu (however, any one or two or more elements with which Z is chosen from Sr, Ba, and calcium), SrMgSi2O8:Eu, Sr2P2O7:Eu, and CaAl2O4: — it consists of any one or 2 or more Eu, Nd, and among the groups of a fluorescent substance come out of and expressed.

[0071] According to the above-mentioned operation gestalt, even if it uses the semi-conductor light emitting device which has which luminescence wavelength of the inside whose luminescence wavelength is 390nm thru/or 420nm, red, monochromatic green, and a monochromatic blue luminescence light are respectively obtained by choosing a suitable fluorescent substance from two or more above-mentioned fluorescent substances corresponding to the luminescence wavelength of this semi-conductor light emitting device. Color mixture of the light of red and green and blue wavelength is respectively carried out appropriately by this, and the luminescent color of the white system of a good color tone is obtained. Moreover, since the light of the wavelength of all abbreviation for the wavelength field which a semi-conductor light emitting device has by combining two or more fluorescent substances is respectively convertible for red and green and blue wavelength, the utilization effectiveness of the outgoing radiation light of a semi-conductor light emitting device improves, and the semi-conductor luminescence equipment of efficient white system luminescence is obtained.

[0072] As for the 1st, 2nd, and 3rd fluorescent substance of the above, for the 1st fluorescent substance of the above, the 2nd fluorescent substance of the above is [the 3rd fluorescent substance of the above of the semi-conductor luminescence equipment of 1 operation gestalt] 30 or less % of the weight 20 % of the weight or more 70 or less % of the weight 50 % of the weight or more 20 or less % of the weight 7 % of the weight or more noting that a total amount is 100 % of the weight.

[0073] According to the above-mentioned operation gestalt, since 50-% of the weight or more 70 or less % of the weight and the 2nd fluorescent substance of the above are [7 % of the weight or more 20 or less % of the weight and the 3rd fluorescent substance of the above] 30 or less % of the weight 20 % of the weight or more for the 1st fluorescent substance of the above, the red in which the 1st fluorescent substance with low visibility carries out outgoing radiation compared with a green light in which the 2nd fluorescent substance of the above carries out outgoing radiation, and the blue luminous intensity the 3rd fluorescent substance carries out [luminous intensity] outgoing radiation are strengthened. Therefore, human being's visibility is taken into consideration and the semi-conductor luminescence equipment of white system luminescence of a good color tone is obtained.

[0074] In here, if there are more mixed ratios of the 1st fluorescent substance of the above than 70 % of the weight while it will turn into white of the color tone which green cut, if the luminescent color of semi-conductor luminescence equipment has few mixed ratios of the 1st fluorescent substance than 50 % of the weight, it will turn into white of the color tone which red cut. Moreover, the luminescent color of the above-mentioned semi-conductor luminescence equipment turns into white of the color tone which red cut when there were few mixed ratios of the 2nd fluorescent substance than 7 % of the weight, and if there are more mixed ratios of the 2nd fluorescent substance of the above than 20 % of the weight, it will turn into white of the color tone which green cut. Moreover, the luminescent color of the above-mentioned semi-conductor luminescence equipment turns into white of the color tone which red cut when there were few mixed ratios of the 3rd fluorescent substance than 20 % of the weight, and if there are more mixed ratios of the 3rd fluorescent substance of the above than 30 % of the weight, it will turn into white of the color tone which green cut.

[0075] As for the above-mentioned closure resin, the semi-conductor luminescence equipment of 1 operation gestalt contains the 1st, 2nd, and 3rd fluorescent substance of the above, and the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance of the above to the weight of the above-mentioned closure resin is one or less [0.5 or more].

[0076] According to the above-mentioned operation gestalt, the semi-conductor luminescence equipment which carries out outgoing radiation of the light of the white system near the natural light is obtained by making the ratio of the AUW of the above-mentioned fluorescent substance to the weight of the above-mentioned closure resin or less [0.5 or more] into one. In addition, if the above-mentioned ratio becomes smaller than 0.5 while the brightness of the outgoing radiation light of semi-conductor luminescence equipment becomes bright and a color tone will become pale, if the above-mentioned ratio becomes larger than 1, while the brightness of the outgoing radiation light of semi-conductor luminescence equipment becomes dark, a color tone will wear redness.

[0077] The luminescence display of 1 operation gestalt is equipped with the light source which used the above-mentioned semi-conductor luminescence equipment, the light guide plate to which the light from the above-mentioned light source is led, and the light filter of green [which are made to penetrate the light from the above-mentioned light guide plate, and carry out a spectrum / the red and green], and blue, and the outgoing radiation light of the above-mentioned semi-conductor luminescence equipment has the wavelength distribution which suited the spectral characteristic of the above-mentioned light filter.

[0078] According to the above-mentioned operation gestalt, the outgoing radiation light from the above-mentioned

semi-conductor luminescence equipment Since it has the above-mentioned red, green, and the wavelength distribution that suited the spectral characteristic of a blue light filter The light to which luminescence wavelength has a peak to a red wavelength field with this light filter, the light which has a peak to the wavelength field where luminescence wavelength is green, and the light which has a peak to the wavelength field where luminescence wavelength is blue — each — since it has suitable reinforcement and a spectrum is carried out — the utilization effectiveness of the light of semi-conductor luminescence equipment — good — moreover — high — it becomes a brightness luminescence display.

[0079] The luminescence display of 1 operation gestalt so that wavelength distribution of the outgoing radiation light of semi-conductor luminescence equipment may suit the spectral characteristic of the above-mentioned light filter The luminescence wavelength of the above-mentioned semi-conductor light emitting device, and the luminescence wavelength of the 1st fluorescent substance of the above, At least one of the luminescence wavelength of the 2nd fluorescent substance of the above, the luminescence wavelength of the 3rd fluorescent substance of the above, the mixed ratio of the 1st, 2nd, and 3rd fluorescent substance of the above, and the ratios of the AUW of the 1st, 2nd, and 3rd fluorescent substance of the above to the weight of the above-mentioned closure resin is adjusted.

[0080] Since according to the above-mentioned operation gestalt it is adjusted certainly and effectively so that the outgoing radiation light from the above-mentioned semi-conductor luminescence equipment may suit the spectral characteristic of the above-mentioned light filter, and the outgoing radiation light from the above-mentioned luminescence display has comparatively large reinforcement by the above-mentioned light filter and a spectrum is carried out to the red of abbreviation monochrome, green, and blue, the above-mentioned luminescence display does not have a color omission etc., and becomes the full color display of high brightness and high contrast.

[0081] The above-mentioned luminescence display of the luminescence display of 1 operation gestalt is a liquid crystal display.

[0082] According to the above-mentioned operation gestalt, there is almost no color omission and the liquid crystal display of high brightness and high contrast is obtained.

[0083]

[Embodiment of the Invention] Hereafter, the operation gestalt of a graphic display explains this invention to a detail.

[0084] Drawing 1 (a), (b), and (c) are the sectional views showing the semi-conductor light emitting device used in the operation gestalt of this invention.

[0085] Drawing 1 (a) is the sectional view showing the semi-conductor light emitting device which has the substrate which consists of an insulating semiconductor material. This semi-conductor light emitting device 7a is carrying out the laminating of the N type gallium nitride system compound semiconductor layer 2, the P type gallium nitride system compound semiconductor layer 3, and the electrode 4 for P type layers that consists of a metal thin film or transparence electric conduction film to order on insulating silicon-on-sapphire 1a. While the pad electrode 5 for N type is formed on the exposed surface formed in right-hand side in drawing 1 (a) of the above-mentioned N type gallium nitride system compound semiconductor layer 2, the pad electrode 6 for P type is formed on the above-mentioned electrode 4 front face for P type layers. If a current is passed between the above-mentioned pad electrode 5 for N type, and the pad electrode 6 for P type, light will be emitted from luminescence field 8a.

[0086] Drawing 1 (b) is the sectional view showing the semi-conductor light emitting device which has the substrate which consists of a conductive semiconductor material. On conductive gallium nitride semi-conductor substrate 1b, this semi-conductor light emitting device 7b carries out the laminating of the electrode 4 for P type layers which consists of the N type gallium nitride system compound semiconductor layer 2, the P type gallium nitride system compound semiconductor layer 3, a metal thin film, or transparence electric conduction film one by one, and is formed. While the pad electrode 5 for N type is formed in the underside of the above-mentioned semi-conductor substrate 1b, the pad electrode 6 for P type is formed in the top face of the above-mentioned electrode 4 for P type layers. If a current is passed between the above-mentioned pad electrode 5 for N type, and the pad electrode 6 for P type, light will be emitted from luminescence field 8b.

[0087] Drawing 1 (c) is the sectional view showing the semi-conductor light emitting device of the type which is made to penetrate a substrate and takes out light. This semi-conductor light emitting device 7c on insulating silicon-on-sapphire 1a (it sets to drawing 1 (c) and is the lower part of silicon-on-sapphire 1a) The laminating of the electrode 4 for P type layers which consists of the N type gallium nitride system compound semiconductor layer 2, the P type gallium nitride system compound semiconductor layer 3, a metal thin film, or transparence electric conduction film is carried out one by one. While forming the pad electrode 5 for N type in the exposed surface of the above-mentioned N type gallium nitride system compound semiconductor layer 2, the pad electrode 6 for P type is formed in the front face of the electrode 4 for P type layers. And as shown in drawing 1 (c), direct ball bonding of the above-mentioned pad electrode 5 for N type and the pad electrode 6 for P type is carried out to metal wiring of submounting which has been arranged under the semi-conductor light emitting device 7c and which is not illustrated etc. by the metal bumps 16a and 16b who consist of Au etc. If a current is passed between the above-mentioned pad electrode 5 for N type, and the pad electrode 6 for P type, light is emitted from the luminescence field 8, and this luminescence light will penetrate the above-mentioned silicon-on-sapphire 1a, and will be emitted up in drawing 1 (c).

[0088] In addition, other ingredients, such as ZnO, GaN, SiC, and ZnSe, may be used for insulating silicon-on-sapphire 1a of the above-mentioned semi-conductor light emitting devices 7a and 7c. Moreover, other ingredients, such as SiC, ZnSe, and Si, may be used for conductive gallium nitride semi-conductor substrate 1b in the above-

mentioned semi-conductor light emitting device 7b. Semi-conductor light emitting device 7b equipped with this conductive semi-conductor substrate 1b Since an electrode is formed also in the underside of the above-mentioned semi-conductor substrate 1b and an electrode can be formed in vertical both sides of semi-conductor light emitting device 7b Compared with the semi-conductor light emitting devices 7a and 7b which have insulator substrate 1a and arrange two electrodes on one side, while being able to form the luminescence field of a semi-conductor layer widely in the same size, there is an advantage that mounting to a leadframe or a mounting substrate is easy.

[0089] As an ingredient of the semi-conductor layer in the above-mentioned semi-conductor light emitting devices 7a, 7b, and 7c, although a nitride system compound semiconductor (InxGayAlzN (x+y+z=1, 0<=x<=1, 0<=y<=1, 0<=z<=1)) can use suitably, semiconductor materials, such as SiC and ZnSe, may be used in addition to it.

[0090] As for the above-mentioned semi-conductor light emitting devices 7a, 7b, and 7c, a wavelength field emits light in the light from 390nm to 420nm. Since human being's visibility to the light of this wavelength field is very low, if the fluorescent substance which changes the light of this wavelength field into the light of other wavelength is used, only the color of the light changed by this fluorescent substance will be recognized as the luminescent color, and the semi-conductor luminescence equipment which has a good color tone will be obtained. If the wavelength of a semi-conductor light emitting device is longer than 420nm, it becomes human being's eyes that it is easy to be recognized as the light, and the light by which wavelength conversion was carried out with the fluorescent substance will be mixed with a direct outgoing radiation light from a semi-conductor light emitting device, and the color tone of the luminescent color will worsen. Moreover, if the wavelength of a semi-conductor light emitting device is shorter than 390nm, this light will carry out melanism of the mould resin as opposed to the resin part currently used for semi-conductor luminescence equipment, and will do the adverse effect of reducing brightness, or deteriorating resin and reducing dependability while it becomes ultraviolet rays harmful to the body.

[0091] Next, the fluorescent substance used for the semi-conductor luminescence equipment of this invention is stated to a detail.

[0092] A following table 1 and a following table 2 are a table having shown the result of having excited various fluorescent substances and having evaluated luminescence brightness using the semi-conductor light emitting device which created the gallium nitride system compound semiconductor whose peak of luminescence wavelength is 410nm as a light emitting device. Moreover, the peak wavelength (nm) of luminescence which excited the above-mentioned fluorescent substance and was obtained is shown simultaneously. In red, green, blue, a bluish green color, and each orange luminescent color, assessment of the brightness of luminescence measured the luminescence brightness for every fluorescent substance, evaluated superiority or inferiority, and gave x to what is inferior to what luminescence brightness is inferior to an excellent thing in O, and is a little inferior to an ordinary thing in O in **. The luminescent color shows red, the peak wavelength about a green fluorescent substance, and the assessment result of brightness, and, as for a table 1, the luminescent color shows blue and a bluish green color, the peak wavelength about an orange fluorescent substance, and the assessment result of brightness, as for a table 2.

[0093]

[A table 1]

発光色	蛍光体	発光ピーク波長（nm）	評価
赤色	$La_2O_2S:Eu$	623	◎
	$Gd_2O_2S:Eu$	625	○
	$Y_2O_2S:Eu$	626	△
	$0.5MgF_2 \cdot 3.5MgO \cdot GeO_2:Mn$	658	◎
	$Y_2O_3:Eu$	611	△
	$Y(P,V)O_4:Eu$	618	△
	$YVO_4:Eu$	618	△
	$CaS:Eu$	655	○
	$CaS:Eu,Tm$	650	◎
緑色	$BaMg_2Al_{16}O_{27}:Eu,Mn$	515	○
	$BaMgAl_{10}O_{17}:Eu,Mn$	512	○
	$ZnS:Cu$	527	△
	$SrAl_2O_4:Eu$	522	◎
	$SrAl_2O_4:Eu,Dy$	522	○
	$ZnO:Zn$	508	△
	$Zn_2GeO_4:Mn$	537	○
	$Zn_2SiO_4:Mn$	525	○
	$Ba_3MgSi_2O_8:Eu,Mn$	512	○
	$Sr_3MgSi_2O_8:Eu,Mn$	532	○

[0094]
[A table 2]

発光色	蛍光体	発光ピーク波長 (nm)	評価
青色	$(Sr, Ca, Ba, Ce)_{10}(PO_4)_6Cl_2:Eu$	457	◎
	$BaMg_2Al_{16}O_{27}:Eu$	455	◎
	$BaMgAl_{10}O_{17}:Eu$	452	○
	$ZnS:Ag$	450	△
	$Sr_{10}(PO_4)_6Cl_2:Eu$	447	○
	$Ca_{10}(PO_4)_6F_2:Sb$	480	△
	$Sr_3MgSi_2O_8:Eu$	462	○
	$SrMgSi_2O_8:Eu$	460	△
	$SrAl_{12}O_{19}:Eu$	400	×
	$Sr_2P_2O_7:Eu$	420	△
	$CaAl_2O_4:Eu, Nd$	440	△
青緑色	$Sr_4Al_{14}O_{25}:Eu$	492	◎
	$Sr_4Al_{14}O_{25}:Eu, Dy$	492	◎
	$(Ba, Ca, Mg)_{10}(PO_4)_6Cl_2:Eu$	482	○
	$Sr_2Si_3O_8 \cdot 2SrCl_2:Eu$	490	△
橙色	$ZnS:Mn$	586	○
	$ZnS:Cu, Mn, Co$	580	○

As shown in a table 1, in order to obtain the luminescent color of the red of high brightness, the fluorescent substance of La2O2 S:Eu, 0.5MgF2 and 3.5 MgO-GeO2:Mn, CaS:Eu, and Tm is suitable, and in order to obtain the green luminescent color of high brightness, the fluorescent substance of SrAl2O4:Eu is suitable. moreover — as shown in a table 2, in order the fluorescent substance of 10(Sr, calcium, Ba, Ce) (PO4) 6Cl2:Eu is suitable in order to obtain the blue luminescent color of high brightness and to obtain the luminescent color of the bluish green color of high brightness — Sr4aluminum14O25:Eu and Sr4aluminum14O25: — the fluorescent substance of Eu and Dy is suitable.

[0095] Drawing 2 thru/or 7 are drawings having shown the emission spectrum and excitation spectrum of the main fluorescent substances which are used for the operation gestalt of this invention. An axis of abscissa is wavelength (nm) and any drawing of an axis of ordinate is relative intensity (%).

[0096] The luminescence wavelength of the semi-conductor light emitting device used for this invention is 390nm thru/or 420nm. The more nearly optimal luminescence wavelength range changes with the class of fluorescent substance excited by the luminescence wavelength of a semi-conductor light emitting device, and the luminescent color of a fluorescent substance.

[0097] For example, when it is going to obtain the luminescent color of the red which has a luminescence wavelength peak in 658nm by fluorescent substance 0.5MgF2 and 3.5 MgO-GeO2:Mn shown in drawing 2 (a), it is effective for the wavelength range of 410nm thru/or 420nm to excite the above-mentioned fluorescent substance by the semi-conductor light emitting device which has the peak of luminescence wavelength so that clearly from drawing 2 (b).

[0098] It is effective to, excite the above-mentioned fluorescent substance on the other hand, by the semi-conductor light emitting device which has the luminescence wavelength of 390nm so that clearly from drawing 3 (b) when it is going to obtain the luminescent color of the red which is fluorescent substance La2O2 S:Eu shown in drawing 3 (a), and has a luminescence wavelength peak in 623nm.

[0099] Originally, although the peak of the excitation wavelength of fluorescent substance 0.5MgF2, 3.5 MgO-GeO2:Mn, and La2O2 S:Eu is in a short wavelength side from 390nm If the luminescence wavelength of the semi-conductor light emitting device which excites a fluorescent substance is shorter than 390nm Since ultraviolet rays harmful to the body will be emitted, it is not practical, and ****** is also given to the resin part currently used for semi-conductor luminescence equipment, and it becomes the cause of lowering of the brightness by the melanism of closure resin, or lowering of the dependability by deterioration of resin.

[0100] Besides the above-mentioned fluorescent substance, Gd2O2 S:Eu, Y2O2 S:Eu, Y2O3:Eu, Y(P, V) O4:Eu, YVO4:Eu, etc. are available with the operation gestalt of this invention. Moreover, these fluorescent substances can be more effectively changed into the light of the red whose peaks of luminescence wavelength are 600nm thru/or 670nm by using more than one using the outgoing radiation light of a semi-conductor light emitting device.

[0101] moreover, fluorescent substance BaMg2aluminum16O27: shown in drawing 4 (a) — it is Eu and Mn, and when it is going to obtain the green luminescent color which has a luminescence wavelength peak in 515nm, it is effective to excite the above-mentioned fluorescent substance by the semi-conductor light emitting device which has the luminescence wavelength of 390nm so that clearly from drawing 4 (b).
[0102] It is effective for the wavelength range of 390nm thru/or 420nm to excite the above-mentioned fluorescent substance by the semi-conductor light emitting device which has the peak of luminescence wavelength so that clearly [, on the other hand, it is fluorescent substance SrAl2O4:Eu shown in drawing 5 (a), and] from drawing 5 (b), when it is going to obtain the green luminescent color which has a luminescence wavelength peak in 522nm.
[0103] original — fluorescent substance BaMg2aluminum16O27:, although the peak of the excitation wavelength of Eu, Mn, and SrAl2O4:Eu is in a short wavelength side from 390nm If the luminescence wavelength of the semi-conductor light emitting device which excites a fluorescent substance is shorter than 390nm Since ultraviolet rays harmful to the body will be emitted, it is not practical, and it has an adverse effect also on the resin part currently used for semi-conductor luminescence equipment, and becomes the cause of lowering of the brightness by the melanism of closure resin, or lowering of the dependability by deterioration of resin.
[0104] except for the above-mentioned fluorescent substance — the operation gestalt of this invention — ZnS:Cu and SrAl2O4: — Eu, Dy, ZnO:Zn, Zn2germanium2O4:Mn, Zn2SiO4:Mn, and Ba<SUB>3MgSi2O8: — Eu, Mn, and Sr3MgSi2O8: — Eu, Mn, etc. are available. Moreover, these fluorescent substances can be more effectively changed into a green light whose peaks of luminescence wavelength are 500nm thru/or 540nm by using more than one using the outgoing radiation light of a semi-conductor light emitting device.
[0105] Moreover, when it is going to obtain the blue luminescent color which has a luminescence wavelength peak in 457nm, it is effective [it is fluorescent substance (Sr, calcium, Ba, Ce) 10(PO4).6Cl2:Eu shown in drawing 6 (a), and] for the wavelength range of 390nm thru/or 400nm to excite the above-mentioned fluorescent substance by the semi-conductor light emitting device which has the peak of luminescence wavelength so that clearly from drawing 6 (b). Originally, although the peak of the excitation wavelength of fluorescent substance (Sr, calcium, Ba, Ce) 10(PO4) 6Cl2:Eu is in a short wavelength side from 390nm If the luminescence wavelength of the semi-conductor light emitting device which excites a fluorescent substance is shorter than 390nm Since ultraviolet rays harmful to the body will be emitted, it is not practical, and it has an adverse effect also on the resin part currently used for semi-conductor luminescence equipment, and becomes the cause of lowering of the brightness by the melanism of closure resin, or lowering of the dependability by deterioration of resin.
[0106] It is effective to, excite the above-mentioned fluorescent substance on the other hand, by the semi-conductor light emitting device which has the luminescence wavelength of 390nm so that clearly [it is fluorescent substance BaMgAl10O17:Eu shown in drawing 7 (a), and] from drawing 7 (b), when it is going to obtain the blue luminescent color which has a luminescence wavelength peak in 452nm. Since ultraviolet rays harmful to the body will be emitted when the luminescence wavelength of the semi-conductor light emitting device which excites a fluorescent substance is originally shorter than 390nm, although the peak of the excitation wavelength of fluorescent substance BaMgAl10O17:Eu is in 390nm, it is not practical, and it has an adverse effect also on the resin part currently used for semi-conductor luminescence equipment, and becomes the cause of lowering of the brightness by the melanism of closure resin, or lowering of the dependability by deterioration of resin.
[0107] except for the above-mentioned fluorescent substance — the operation gestalt of this invention — BaMg2aluminum16O27:Eu, ZnS:Ag, and Sr10(PO4) 6Cl2: — Eu, calcium10(PO4) 6F2:Sb, Sr3MgSi2O8:Eu, SrMgSi2O8:Eu, Sr2P2O7:Eu, and CaAl2O4: — Eu, Nd, etc. are available. Moreover, the outgoing radiation light of a semi-conductor light emitting device can be more effectively changed into a blue light whose peaks of luminescence wavelength are 410nm thru/or 480nm by using two or more these fluorescent substances.
[0108] It Eu(s) and D(ies). furthermore, an activity application — responding — Sr4aluminum14O25:Eu and Sr4aluminum14O25: — Any one of fluorescent substances, such as 10(PO4) 6Cl2:Eu, and Sr2Si3O8, 2SrCl2:Eu, (Ba, calcium, Mg) Or the outgoing radiation light of a semi-conductor light emitting device is effectively convertible for the light of the bluish green color whose peaks of luminescence wavelength are 480nm thru/or 500nm by using plurality.
[0109] Moreover, the outgoing radiation light of a semi-conductor light emitting device is convertible for a fluorescent substance by using ZnS:Mn, ZnS:Cu, and Mn and Co at an orange light whose peaks of luminescence wavelength are 570nm thru/or 600nm.
[0110] Hereafter, the semi-conductor luminescence equipment of the operation gestalt of this invention is explained in detail with reference to a drawing.
[0111] (1st operation gestalt) Drawing 8 (a) thru/or (c) are the sectional views showing the semi-conductor luminescence equipment of the 1st operation gestalt of this invention.
[0112] Drawing 8 (a) is the sectional view of the ramp-type semi-conductor luminescence equipment which closed the above-mentioned semi-conductor light emitting device 7a with the mould resin as closure resin of the shape of ramp type which it had [shape] semi-conductor light emitting device 7a which has an insulating substrate, and distributed the fluorescent substance.
[0113] This semi-conductor luminescence equipment has mounting section 10a which is the depression of a cup configuration at the head of the leadframe 101 as a base. The above-mentioned semi-conductor light emitting device 7a is being fixed to mounting section 10a of this cup configuration with the adhesives 11 which consist of an epoxy resin etc. P lateral electrode 6a prepared in the top face of the above-mentioned semi-conductor light emitting device 7a is connected to polar-zone 10b of a leadframe 101 by metal wire 6p which consists of Au,

aluminum, Cu, etc. Moreover, N lateral electrode 5a prepared in the top face of the above-mentioned semi-conductor light emitting device 7a is connected to polar-zone 10c of the right-hand side leadframe 102 by metal wire 5n. And the upper part of above-mentioned semi-conductor light emitting device 7a and a leadframe 101,102 is closed with the mould resin 130 which distributed the fluorescent substance, such as an epoxy resin of translucency, and ramp type-like semi-conductor luminescence equipment is formed. In addition, the adhesives 11 which join the above-mentioned semi-conductor light emitting device 7a and mounting section 10a of a leadframe 101 will not be limited especially if it is the ingredient which does not absorb the light from semi-conductor light emitting device 7a. For example, the resin ingredient containing the ingredient which reflects and scatters the other light efficiently etc. may be used for mounting section 10a of a leadframe 101 from the resin ingredient which mixed the thermally conductive good metallic material for the heat-characteristic improvement of the above-mentioned semi-conductor light emitting device 7a, and above-mentioned semi-conductor light emitting device 7a.

[0114] Drawing 8 (b) is the sectional view of the ramp-type semi-conductor luminescence equipment which closed the above-mentioned semi-conductor light emitting device 7b with the mould resin 130 as closure resin of the shape of ramp type which it had [shape] semi-conductor light emitting device 7b which has a conductive substrate, and distributed the fluorescent substance. Among drawing, the part which has the same function as the semi-conductor luminescence equipment shown in drawing 8 (a) attaches the same reference number, and omits detailed explanation.

[0115] As for this semi-conductor luminescence equipment, direct continuation of the N lateral electrode section 5of above-mentioned semi-conductor light emitting device 7b b is carried out to mounting section 10a of a leadframe 101 by the adhesives 15 which consist of the conductive wax material or Au-epoxy resin which consists of metal systems, such as an indium, an Ag-epoxy resin, etc. On the other hand, P lateral electrode 6b prepared in the top face of the above-mentioned semi-conductor light emitting device 7b is connected to polar-zone 10c of the right-hand side leadframe 102 by metal wire 6p in drawing 8 (b). And the upper part of above-mentioned semi-conductor light emitting device 7b and a leadframe 101,102 is closed with the mould resin 130 which distributed the fluorescent substance, and forms ramp type-like semi-conductor luminescence equipment. Since the electrodes 6b and 5b with which semi-conductor light emitting device 7b was prepared up and down are the same as that of the semi-conductor light emitting device of the conventional GaAs system or a GaP system, the leadframe used for conventional semi-conductor luminescence equipment can be used as it is.

[0116] Drawing 8 (c) is the sectional view of the ramp-type semi-conductor luminescence equipment which closed the above-mentioned semi-conductor light emitting device 7c with the mould resin 130 as closure resin of the shape of ramp type which it had [shape] semi-conductor light emitting device 7c which has an insulating substrate, and this semi-conductor light emitting device 7c and leadframe 103,103 were connected [shape], without using a metal wire, and distributed the fluorescent substance.

[0117] This semi-conductor luminescence equipment has connected the submounting 17 as a base at the head of the leadframe 103,103 which countered mutually and has been arranged. This submounting 17 consists of Si, it is insulation and the electrode wiring 17a and 17b is formed in the top face of the submounting 17. The above-mentioned semi-conductor light emitting device 7c makes a semi-conductor layer side face (bottom side of semi-conductor light emitting device 7c in drawing 1 (c)) counter the top face of this submounting 17, and is carried in it. P lateral electrode 6c and N lateral electrode 5c which were prepared in the bottom side of the above-mentioned semi-conductor light emitting device 7c are connected to the electrode wiring 17a and 17b formed in the top face of the above-mentioned submounting 17 using Au bump etc. It connected with the points 10d and 10e of a leadframe, and the electrode wiring 17a and 17b formed in the top face of the above-mentioned submounting 17 is connected to the exterior and an electric target. And it closes with the mould resin 130 which consists a fluorescent substance of a distributed epoxy resin in above-mentioned semi-conductor light emitting device 7c and the submounting 17, and the upper part of a leadframe 103,103, and ramp type-like semi-conductor luminescence equipment is formed. Since this semi-conductor luminescence equipment is carrying out direct continuation of the above-mentioned semi-conductor light emitting device 7c to the submounting 17, it has the advantage that the heat from the luminescence field of the above-mentioned semi-conductor light emitting device 7c can be quickly missed to the exterior of semi-conductor luminescence equipment through the submounting 17 and a leadframe 103,103.

[0118] The semi-conductor luminescence equipment of the shape of ramp type shown in drawing 8 (a), (b), and (c) The light emitted has the other directivity above drawing 8 (a), (b), and (c). Especially the semi-conductor luminescence equipment of drawing 8 (a) and (b) Since the light by which outgoing radiation was carried out from the semi-conductor light emitting devices 7a and 7b is condensed efficiently, mounting section 10a of a leadframe 101 is formed in the cup configuration. The thermosetting which has the translucency of silicon resin, urethane resin, polycarbonate resin, etc. in addition to an epoxy resin, and thermoplastic resin may be used for the above-mentioned mould resin 130. Moreover, although the mould resin 130 whole may be made to distribute the above-mentioned fluorescent substance to homogeneity, if the content ratio of a fluorescent substance is gradually made high toward the semi-conductor light emitting devices 7a, 7b, and 7c from the front face of mould resin 130, degradation of the fluorescent substance under the effect of the moisture from the outside of mould resin 130 etc. can be reduced. moreover, the fluorescent substance by the semi-conductor light emitting devices 7a, 7b, and 7c if the content ratio of a fluorescent substance is gradually made high toward the front face of mould resin 130 from the semi-conductor light emitting devices 7a, 7b, and 7c — electric and thermal effect can also be eased. Thus, distribution of the fluorescent substance in mould resin 130 can make various gestalten according to the class of mould resin, the class of fluorescent substance, an operating environment, conditions, or an application.

[0119] (2nd operation gestalt) Drawing 9 (a) and (b) are the sectional views having shown the semi-conductor luminescence equipment in the 2nd operation gestalt of this invention. The semi-conductor luminescence equipment of drawing 9 (a) is the same as the semi-conductor luminescence equipment shown in drawing 8 (a) except mould resin 131 not containing a fluorescent substance while being filled up with a fluorescent substance in mounting section 10a of a leadframe 101. Also about the semi-conductor luminescence equipment of drawing 9 (b), while being filled up with a fluorescent substance in mounting section 10a of a leadframe 101, it is the same as that of the semi-conductor luminescence equipment shown in drawing 8 (b) except mould resin 131 not containing a fluorescent substance. Therefore, the same reference number is given to the part which has the same function as the semi-conductor luminescence equipment shown in drawing 8 (a) and (b), and detailed explanation is omitted. Also in other following operation gestalten, it is the same.

[0120] While the semi-conductor luminescence equipment shown in drawing 9 (a) and (b) arranges the semi-conductor light emitting devices 7a and 7b at the bottom of mounting section 10a of a cup configuration, it fills up this mounting section 10a with a fluorescent substance 12, and he is trying to change the wavelength of the light from the semi-conductor light emitting devices 7a and 7b with this fluorescent substance 12. That is, by arranging the above-mentioned fluorescent substance 12 to mounting section 10a which collects the light from the semi-conductor light emitting devices 7a and 7b, it does not leak, the light from the semi-conductor light emitting devices 7a and 7b is transformed, and the conversion efficiency of light is raised. Therefore, compared with the case where the whole mould resin [as / in the operation gestalt of the above 1st] is made to distribute a fluorescent substance, the color tone of semi-conductor luminescence equipment is good, and since what is necessary is to arrange a fluorescent substance only in mounting section 10a moreover, the amount of the fluorescent substance used is reduced.

[0121] In the above-mentioned operation gestalt, although filled up with the fluorescent substance 12 in [of a leadframe 101 / whole] mounting section 10a, as long as the bleedoff light from the semi-conductor light emitting devices 7a and 7b is convertible for wavelength predetermined enough, you do not need to make it filled up with a fluorescent substance 12 in [whole] mounting section 10a not necessarily, and a concave may be filled up with a fluorescent substance 12 in mounting section 10a. Or what is necessary is to have been filled up with the fluorescent substance 12 so that it might rise to convex rather than the above-mentioned mounting section 10a upper bed, and just to, have filled up mounting section 10a with the fluorescent substance 12 of an amount which can change the wavelength of the light from the semi-conductor light emitting devices 7a and 7b into desired wavelength in short.

[0122] (3rd operation gestalt) Drawing 10 (a) and (b) are the sectional views showing the semi-conductor luminescence equipment of the 3rd operation gestalt of this invention. The semi-conductor luminescence equipment of drawing 10 (a) is the same as the semi-conductor luminescence equipment shown in drawing 9 (a) in mounting section 10a of a leadframe 101 except having arranged pre coating 13a so that the whole semi-conductor light emitting device 7a may be covered, and having arranged the fluorescent substance 12 on it. It is the same as that of the semi-conductor luminescence equipment shown in drawing 9 (b) except having arranged pre coating 13a so that the whole semi-conductor light emitting device 7a may be covered in mounting section 10a of a leadframe 101, and having arranged the fluorescent substance 12 on it also about the semi-conductor luminescence equipment of drawing 10 (b). Therefore, the same reference number is given to the part which has the same function as the semi-conductor luminescence equipment shown in drawing 9 (a) and (b), and detailed explanation is omitted.

[0123] In drawing 10 (a) and (b), pre coating 13a which consists of an epoxy resin, silicon resin, urethane resin, etc. so that the semi-conductor light emitting devices 7a and 7b may be arranged and this semi-conductor light emitting device 7a and the whole 7b may be covered is formed in the bottom of mounting section 10a of the cup configuration formed at left-hand side leadframe 101 head. The fluorescent substance 12 is arranged in the shape of a layer so that the above-mentioned mounting section 10a inside may be filled on this pre coating 13. The above-mentioned fluorescent substance 12 carries out dipping of the mounting section 10a in which pre coating 13a was formed, or forms it on the pre coating 13 potting or the fuel spray, and by vapor-depositing on pre coating 13a in mounting section 10a. In drawing 10 (a) and (b), although the fluorescent substance 12 was formed only inside [mounting section 10a] the leadframe 101, you may form so that all the top faces of a leadframe 101 may be covered.

[0124] The above-mentioned fluorescent substance 12 sets the abbreviation equal distance by pre coating 13a from the luminescence field of the semi-conductor light emitting devices 7a and 7b, and the semi-conductor luminescence equipment shown in drawing 10 (a) and (b) is formed in homogeneity thickness. Therefore, a uniform luminescence light in which this semi-conductor luminescence equipment does not have nonuniformity is obtained by that abbreviation etc. requires the quantity of light passed in all the fields of a fluorescent substance 12 by carrying out. Moreover, since a fluorescent substance 12 is arranged in the location estranged from the semi-conductor light emitting devices 7a and 7b, the electric and thermal effect of a semi-conductor light emitting device to a fluorescent substance 12 can be eased. Consequently, a luminescence property is good and, moreover, semi-conductor luminescence equipment with sufficient endurance is obtained.

[0125] (4th operation gestalt) Drawing 11 (a) and (b) are the sectional views showing the semi-conductor luminescence equipment by the 4th operation gestalt of this invention.

[0126] Drawing 11 (a) carries semi-conductor light emitting device 7a which has an insulating substrate on the printed-circuit board 18 as a base, and is closing the above-mentioned semi-conductor light emitting device 7a with the mould resin 132 as closure resin which distributed the fluorescent substance.

[0127] This semi-conductor luminescence equipment has pasted up semi-conductor light emitting device 7a with the adhesives 11 which consist of an epoxy resin on the printed-circuit board 18 of the rectangular parallelepiped configuration which consists of glass epoxy which has thermal resistance. P lateral electrode 6a and N lateral electrode 5a which were prepared in the top face of this semi-conductor light emitting device 7a are respectively connected to the polar zone 18a and 18b of printed-circuit board 18 top face by the metal wires 6p and 5n. Through the through hole of the shape of cross-section radii which connects the top face and underside of a printed-circuit board 18 which is not illustrated, these polar zone 18a and 18b was taken about on the underside of the printed-circuit board 18 as a component side, and is prolonged even to the both ends of this component side. In addition, an insulating film may be used for the above-mentioned printed-circuit board 18.

[0128] And on the above-mentioned printed-circuit board 18, it forms so that a parabolic edge section as shows the mould resin 132 which distributed the fluorescent substance, such as an epoxy resin as closure resin (for example, translucency), to drawing 11 (a) may be made, and the semi-conductor luminescence equipment of a chip part shape is formed so that the above-mentioned whole semi-conductor light emitting device 7a may be covered.

[0129] The adhesives 11 on which the above-mentioned semi-conductor light emitting device 7a and a printed-circuit board 18 are pasted up will not be limited especially if it is the ingredient with which the light from semi-conductor light emitting device 7a is not absorbed. For example, the resin ingredient which mixed the thermally conductive good metallic material for the heat-characteristic improvement of semi-conductor light emitting device 7a, the resin ingredient containing the ingredient which reflects and scatters efficiently the light emitted toward the printed-circuit board 18 from semi-conductor light emitting device 7a, etc. may be used. However, to use the resin ingredient containing a metallic material, it is necessary to take care that P lateral electrode 6a and N lateral electrode 5a do not connect too hastily.

[0130] Drawing 11 (b) is the same as that of the semi-conductor luminescence equipment of drawing 11 (a) except having semi-conductor light emitting device 7c which changes to semi-conductor light emitting device 7a in drawing 11 (a), and has an insulating substrate. Therefore, the same reference number is given to the part which has the same function as drawing 11 (a), and detailed explanation is omitted.

[0131] In the semi-conductor luminescence equipment of drawing 11 (b), semi-conductor light emitting device 7c carries out outgoing radiation of the light through the insulating substrate located in an upside in drawing 11 (b) of semi-conductor light emitting device 7c. The above-mentioned semi-conductor light emitting device 7c is carrying out direct continuation of P lateral electrode 6c and N lateral electrode 5c which were formed in the semi-conductor laminating side which is the bottom in drawing 11 (b) to the polar zone 18a and 18b on a printed-circuit board 18 respectively through Au bump. In addition, semi-conductor light emitting device 7c may be carried in submounting which consists of Si beforehand given to metal wiring, and this submounting may be electrically connected to a printed-circuit board 18 with die bond, wire bond, etc. Since this semi-conductor luminescence equipment turns the field by the side of a semi-conductor laminating to a printed-circuit board 18 and mounts semi-conductor light emitting device 7c, it can miss quickly the heat from the luminescence field of the above-mentioned semi-conductor light emitting device 7c to the exterior.

[0132] The thermosetting which has the translucency of silicon resin, urethane resin, Pori force-BONETO resin, etc. in addition to an epoxy resin, and thermoplastic resin may be used for the mould resin 132 in the semi-conductor luminescence equipment of drawing 11 (a) and (b). Moreover, although the mould resin 132 whole may be made to distribute a fluorescent substance to homogeneity, if the content ratio of a fluorescent substance is gradually made high toward a semi-conductor light emitting device from the front face of mould resin 132, degradation of the fluorescent substance under the effect of moisture etc. can be reduced. Moreover, if the content ratio of a fluorescent substance is gradually made high toward the front face of mould resin 132 from the semi-conductor light emitting devices 7a and 7c, the electric and thermal effect of the semi-conductor light emitting devices 7a and 7c to a fluorescent substance can be eased. Thus, distribution of the fluorescent substance in mould resin 132 can make various gestalten according to the class of mould resin, the class of fluorescent substance, an operating environment, conditions, an application, etc.

[0133] In addition, it may change to the above-mentioned semi-conductor light emitting devices 7a and 7c, and semi-conductor light emitting device 7b which has a conductive substrate may be used. In this case, direct continuation of the N type electrode formed in the underside of semi-conductor light emitting device 7b is carried out to one electrode on a printed-circuit board with the adhesives which have conductivity. P lateral electrode prepared in the top face of the above-mentioned semi-conductor light emitting device 7b is connected to the polar zone of another side on a printed-circuit board with a metal wire. Like the semi-conductor luminescence equipment of the conventional GaAs system or a GaP system, since the above-mentioned semi-conductor light emitting device 7b has an electrode to vertical both sides of semi-conductor light emitting device 7b, it has the advantage that the conventional leadframe can be used as it is.

[0134] (5th operation gestalt) Drawing 12 (a) and (b) are the sectional views showing the semi-conductor luminescence equipment of the 5th operation gestalt of this invention. The semi-conductor luminescence equipment of drawing 12 (a) is equipped with the frame 19 which consists of resin on the printed-circuit board 18 as a base. Semi-conductor light emitting device 7b which is on this printed-circuit board 18, and has a conductive substrate inside the above-mentioned resin frame 19 is arranged. And it is filled up with the mould resin 134 as closure resin which contains a fluorescent substance inside the above-mentioned resin frame 19, and semi-conductor light emitting device 7b is closed.

[0135] This semi-conductor luminescence equipment has formed the frame 19 which consists of resin on the

printed circuit board 18 of the rectangular parallelepiped configuration which consists of glass epoxy which has thermal resistance. When this resin frame 19 is filled up with mould resin 134 inside, it has the height whose resin 134 is fully wrap extent about semi-conductor light emitting device 7b. In the inside of this frame 19, one polar-zone 18a on a printed-circuit board 18 and N lateral electrode 5b under semi-conductor light emitting device 7b are pasted up and connected with the adhesives which have conductivity. On the other hand, P lateral electrode 6b prepared in the top face of semi-conductor light emitting device 7b is connected to polar-zone 18b of another side on a printed-circuit board 18 by metal wire 6p. Through the through hole of the shape of cross-section radii which penetrates a printed-circuit board 18 which is not illustrated, these polar zone 18a and 18b was taken about in three dimensions from the top face of a printed-circuit board 18 to the underside which is a component side, and is prolonged even to the ends of printed-circuit board 18 underside, respectively. The above-mentioned printed-circuit board 18 top and inside the resin frame 19, it fills up with the mould resin 134 which consists of an epoxy resin of the translucency which distributed the fluorescent substance so that the whole semi-conductor light emitting device 7b may be covered. Since the above-mentioned semi-conductor light emitting device 7b has Electrodes 6b and 5b to vertical both sides like the semi-conductor light emitting device of the conventional GaAs system or a GaP system, it has the advantage that it is common and the conventional leadframe can be used. In addition, as a base, the insulating film other than the above-mentioned printed-circuit board may be used.

[0136] The semi-conductor luminescence equipment of drawing 12 (b) is filled up with the mould resin 134 as closure resin which distributed the fluorescent substance while it is equipped with resin frame 19a on the printed circuit board 18 as a base and is equipped with semi-conductor light emitting device 7c which has an insulating substrate inside this resin frame 19a. The above-mentioned resin frame 19a inclines so that the side face facing semi-conductor light emitting device 7c may reflect the light by which outgoing radiation was carried out to the longitudinal direction from the side face of semi-conductor light emitting device 7c in the direction of a right angle of a printed circuit board 18.

[0137] This semi-conductor luminescence equipment is equipped with resin frame 19a toward which the side face which faces at semi-conductor light emitting device 7c on the printed circuit board 18 of the rectangular parallelepiped configuration which consists of glass epoxy inclined. The above-mentioned semi-conductor light emitting device 7c turns a semi-conductor laminating side face downward, and is carried in the printed-circuit board 18. P lateral electrode 6c and N lateral electrode 5c with which semi-conductor light emitting device 7c is equipped are respectively connected to the polar zone 18a and 18b on a printed-circuit board 18 through Au bump. The above-mentioned polar zone 18a and 18b is taken about in three dimensions to an underside like the semi-conductor luminescence equipment shown in drawing 12 (a) through the through hole which is not illustrated from the top face of a printed-circuit board 18, and is extended even to the underside ends of a printed-circuit board 18. In addition, as a base, the insulating film other than the above-mentioned printed-circuit board 18 may be used. Moreover, although direct continuation of the above-mentioned semi-conductor light emitting device 7c was carried out to the printed-circuit board 18, it may carry semi-conductor light emitting device 7c in submounting which gives metal wiring beforehand and consists of Si, and may connect this submounting to a printed-circuit board 18 electrically with die bond, wire bond, etc.

[0138] Since this semi-conductor luminescence equipment mounts the semi-conductor laminating side face of semi-conductor light emitting device 7c in the immediate printing wiring substrate 18, it has the advantage that the heat from the luminescence field of semi-conductor light emitting device 7c can be quickly missed to the exterior through submounting and a leadframe.

[0139] The mould resin 134 in the semi-conductor luminescence equipment of drawing 12 (a) and (b) is the same ingredient as the mould resin 13 of drawing 8 (a), (b), and (c), and distribution of the fluorescent substance in the above-mentioned mould resin can take various gestalten according to the class of mould resin, the class of fluorescent substance, an operating environment, conditions, an application, etc.

[0140] In drawing 12 (a) and (b), although the above-mentioned resin frames 19 and 19a were stuck on the printed-circuit board 18 after forming them apart from a printed-circuit board 18, they may remove some thicker printed-circuit boards, may form a crevice, and may use the surroundings of this crevice as a frame. Furthermore, while forming a through hole in a printed-circuit board, arranging an electrode-cum-wiring by the metallic foil on the base of this printed-circuit board and arranging a semi-conductor light emitting device after an electrode-cum-this wiring, the above-mentioned through hole part may be closed by closure resin.

[0141] Moreover, in the semi-conductor luminescence equipment of drawing 12 (a) and (b), semi-conductor light emitting device 7a shown in drawing 1 (a) is sufficient as the semi-conductor light emitting devices 7b and 7c, and when this semi-conductor light emitting device 7a is used, they connect the electrode of semi-conductor light emitting device 7a, and the polar zone of a printed-circuit board with a metal wire.

[0142] (6th operation gestalt) Drawing 13 is the sectional view showing the semi-conductor luminescence equipment in the 6th operation gestalt of this invention.

[0143] This semi-conductor luminescence equipment has the same frame 19a as the frame with which the semi-conductor luminescence equipment shown in drawing 12 (b) is equipped. This frame 19a is installed on the printed circuit board 18 as a base of the shape of a rectangular parallelepiped which consists of glass epoxy, and the side face facing semi-conductor light emitting device 7c of this frame 19a inclines so that the light from the side face of semi-conductor light emitting device 7c may be reflected in the direction of a right angle of a printed circuit board 18. The above-mentioned semi-conductor light emitting device 7c is carried on the printed-circuit board 18 so that outgoing radiation of the light may be carried out [in / for a semi-conductor laminating side / drawing 13] from an

upper substrate side towards the bottom in drawing 13 . The electrodes 6c and 5c of this semi-conductor light emitting device 7c are being connected to the polar zone 18a and 18b of a printed-circuit board 18 by the bump like the semi-conductor luminescence equipment shown in drawing 12 (b). It is filled up with the mould resin 135 as closure resin of the translucency which consists of an epoxy resin inside frame 19a arranged on the above-mentioned printed-circuit board 18, and the above-mentioned semi-conductor light emitting device 7c is closed. And on above-mentioned frame 19a and mould resin 13, a fluorescent substance 12 has predetermined thickness and is formed in the shape of a layer.

[0144] Since the fluorescent substance 12 is formed in the location of the abbreviation equal distance by the thickness of homogeneity from the luminescence field of semi-conductor light emitting device 7c, in the location of all the fluorescent substances 12, uniform luminescence which does not have nonuniformity by the quantity of light which passes a fluorescent substance 12 becoming abbreviation regularity is possible for the semi-conductor luminescence equipment in this operation gestalt. Moreover, since the above-mentioned fluorescent substance 12 keeps a predetermined distance and is formed from semi-conductor light emitting device 7c, it can ease the electric and thermal effect of a semi-conductor light emitting device to a fluorescent substance 12.

[0145] With the above-mentioned operation gestalt, although the fluorescent substance 12 was formed also in the top face of resin frame 19a, as long as resin frame 19a is formed with the ingredient of protection-from-light nature, it may form a fluorescent substance 12 in the upper chisel of mould resin 135. Moreover, the height of resin frame 19a is made high, after filling up extent slightly exceeding the upper bed of semi-conductor light emitting device 7c with mould resin 13, it is in the above-mentioned resin frame 19a, and a fluorescent substance may be arranged by potting etc. on the above-mentioned mould resin 135.

[0146] The above-mentioned resin frame 19a may use as a frame the heights which removed some thicker printed-circuit boards 18 like the time of describing the semi-conductor luminescence equipment of drawing 12 (b), and remained. Furthermore, an electrode-cum-wiring by the metallic foil may be prepared in the pars basilaris ossis occipitalis of a printed-circuit board which has a through hole, and a crevice may be formed in it.

[0147] Moreover, although the optical drawing effectiveness to the exterior falls, the resin frame in which the side face facing semi-conductor light emitting device 7c was formed vertically may be used.

[0148] In addition, the semi-conductor light emitting devices 7a and 7b shown in drawing 1 may be used for the above-mentioned semi-conductor light emitting device 7c. Especially semi-conductor light emitting device 7b that has a conductive substrate equips an upside and the bottom with an electrode, and since it is the same electrode structure as the semi-conductor light emitting device of the conventional GaAs system or a GaP system, it has the advantage that the conventional leadframe can be used as it is.

[0149] (7th operation gestalt) Drawing 14 (a) and (b) are the sectional views showing the semi-conductor luminescence equipment in the 7th operation gestalt of this invention.

[0150] Drawing 14 (a) is the sectional view which looked at this semi-conductor luminescence equipment from luminescence, and drawing 14 (b) is the sectional view seen from the right angle to the luminescence direction.

[0151] P lateral electrode 6a and N lateral electrode 5a which semi-conductor light emitting device 7a pasted up this semi-conductor luminescence equipment with the adhesives 11, such as an epoxy resin, on the printed-circuit board 18 as a base of the shape of a rectangular parallelepiped which consists of glass epoxy, and were prepared on the top face of this semi-conductor light emitting device 7a are respectively connected to the polar zone 18a and 18b of a printed-circuit board 18 by the metal wires 6p and 5n. These polar zone 18a and 18b was taken about in three dimensions on the underside of a printed-circuit board 18 through the through holes 19 and 19 of the shape of cross-section radii formed by penetrating a printed-circuit board 18, and is prolonged to the ends of the component side which is an underside of this printed-circuit board 18. In addition, it may change to the above-mentioned printed-circuit board 18, and an insulating film may be used.

[0152] Furthermore, the above-mentioned whole semi-conductor light emitting device 7a is closed with the mould resin 136 as closure resin which consists of an epoxy resin of the translucency which distributed the fluorescent substance. While this mould resin 136 has the abbreviation quadrant elliptical cross section where a left side edge and a bottom edge make a straight line in drawing 14 (b), it has the rectangle cross section where the cross direction is longer than the height direction in drawing 14 (a). And the reflector 20 for reflecting the light from above-mentioned semi-conductor light emitting device 7a on the above-mentioned mould resin 136 is formed.

[0153] As for the above-mentioned mould resin 136, it is desirable to use the thermosetting resin which has translucency and can also bear the elevated temperature in the case of a solder reflow in a mounting process, and it forms it by the resin potting method, the transfermold method, the injection molding method, etc. on a printed-circuit board 18. The top face of the above-mentioned mould resin 136 arranges semi-conductor light emitting device 7a more nearly up than center line I-I of this parabola while a parabola is made and it curves, as shown in drawing 14 (b). Moreover, the outgoing radiation side face A of the light of the above-mentioned mould resin 136 is formed evenly, and is made into the side face and abbreviation same side of a printed-circuit board 18. In addition, the curved surface of the above-mentioned mould resin 136 may be formed so that the above-mentioned semi-conductor light emitting device 7a may be caudad located rather than center line I-I of the parabola of a curved surface.

[0154] Including at least the ingredient which reflects the light by which wavelength conversion was carried out with the light and the fluorescent substance 12 of semi-conductor light emitting device 7a, like the above-mentioned mould resin 136, using the thermosetting resin or thermoplastics which can also bear the elevated temperature in the case of a solder reflow, the above-mentioned reflector 20 is formed by the resin potting method, the

transfermold method, the injection molding method, etc. so that the upside side of the above-mentioned mould resin 136 may be covered. The right side edge edge of a reflector 20 makes a straight line, and as shown in the cross section of drawing 14 (b), while the bottom edge curves in contact with the upside edge of mould resin 136, this reflector 20 is formed so that the right side edge side of the above-mentioned printed-circuit board 18 may be followed, so that the flat surface as the optical outgoing radiation side A of mould resin 136 where a left side edge edge is the same may be made. And the upper bed edge of the above-mentioned reflector is formed in parallel at the above-mentioned printed-circuit board 18. As for this semi-conductor luminescence equipment, the interface of the top face of mould resin 136 and the underside of a reflector 20 is a reflector. While diffusing the light which reflects and carries out outgoing radiation in this reflector on the left-hand side of horizontal in drawing 14 (a), it is interrupted with a reflector 20 and a printed-circuit board 18 in the vertical direction. Therefore, the direct light and the reflected light from semi-conductor light emitting device 7a serve as directional characteristics extracted horizontally. Specifically, the horizontal half power angle in exposure light has **65 degrees and the directional characteristics whose vertical half power angle is **30 degrees. therefore — since wavelength conversion is carried out with the fluorescent substance 12 in mould resin 136, it is reflected by the reflector 20 and outgoing radiation of it is carried out from the lateral portion of mould resin 136 to the exterior, while the light from semi-conductor light emitting device 7a carries out direct outgoing radiation — horizontal — an effective exposure field — large — and high — brightness side luminescence mold semi-conductor luminescence equipment can be offered.

[0155] In addition, since the reflector 20 should have reflex action only into the part which touches mould resin 136, it is good to prepare the reflecting layer which becomes either the upside side where mould resin 136 curved, or the bottom side as for which the reflector 20 carried out the bend from a metal, a white coating, etc.

[0156]. The resin which pastes up the above-mentioned semi-conductor light emitting device 7a on a printed-circuit board 18 is [that there is especially no definition] available if the light from semi-conductor light emitting device 7a is not absorbed. For example, the resin which mixed the thermally conductive good metal for the heat-characteristic improvement of semi-conductor light emitting device 7a, the resin containing the ingredient which reflects and scatters efficiently the light emitted in the direction of the leadframe mounting section, etc. may be used. However, to use the resin containing a metal, it is necessary to take care that P lateral electrode and N lateral electrode do not short-circuit.

[0157] In addition, in the semi-conductor luminescence equipment in this operation gestalt, it may change to the above-mentioned semi-conductor light emitting device 7a, and semi-conductor light emitting device 7b which equips with an electrode the top face and underside which were shown in drawing 1 (b), respectively, and semi-conductor light emitting device 7c of the type which carries out outgoing radiation of the light from the substrate side shown in drawing 1 (c) may be used. Since the above-mentioned semi-conductor light emitting device 7b has the same electrode structure as the semi-conductor luminescence equipment of the conventional GaAs system or a GaP system, it has the advantage that the conventional leadframe can be used as it is. Since the above-mentioned semi-conductor light emitting device 7c mounts a semi-conductor laminating side face in direct electric wiring, it has the advantage that the heat from a luminescence field can be promptly missed to the exterior through a submounting leadframe.

[0158] (8th operation gestalt) Drawing 15 (a) and (b) are the sectional views showing the side luminescence mold semi-conductor luminescence equipment as 8th operation gestalt of this invention.

[0159] Drawing 15 (a) shows the sectional view which looked at this semi-conductor luminescence equipment from luminescence, and drawing 15 (b) is the sectional view seen from the right angle to the luminescence direction. The semi-conductor luminescence equipment of drawing 15 (a) and (b) used semi-conductor light emitting device 7b which has an electrode for the top face and the underside, Except having formed the fluorescent substance 12 in the outgoing radiation side A side of the light of the mould resin 137 as closure resin in the shape of a layer, without distributing a fluorescent substance in closure resin It is the same as that of the semi-conductor luminescence equipment of drawing 14 (a) and (b), and the same reference number is given to the part which has the same function, and detailed explanation is omitted.

[0160] The amount of the light which passes in the abbreviation whole region of a fluorescent substance 12 becomes always fixed [equipment], since this side luminescence mold semi-conductor luminescence equipment formed the fluorescent substance 12 in the location of the abbreviation equal distance from the luminescence field of semi-conductor light emitting device 7b at the thickness of homogeneity, and uniform luminescence without nonuniformity is attained. Moreover, since the fluorescent substance 12 has been arranged in the location estranged from semi-conductor light emitting device 7b, the effect by the current and heat of semi-conductor light emitting device 7b to a fluorescent substance 12 can be eased. Moreover, since the type which has arranged Electrodes 6b and 5b on the top face and the underside in the above-mentioned semi-conductor light emitting device 7b has same semi-conductor light emitting device and electrode structure of the conventional GaAs system or a GaP system, it has the advantage that the conventional leadframe can be used as it is.

[0161] In the operation gestalt of this invention, the above-mentioned semi-conductor light emitting device 7b may use semi-conductor light emitting device 7a of drawing 1 (a), and semi-conductor light emitting device 7c of drawing 1 (c).

[0162] (9th operation gestalt) Drawing 16 (a) and (b) are drawings showing the side luminescence mold semi-conductor luminescence equipment which is the 9th operation gestalt of this invention.

[0163] Drawing 16 (a) is the sectional view which looked at this semi-conductor luminescence equipment from luminescence, and (b) is the sectional view seen from the right angle to the luminescence direction. This semi-

conductor luminescence equipment is equipped with the mould resin 139 as closure resin which closes semi-conductor light emitting device 7c on the printed-circuit board 18 as a base. This mould resin 139 has the left-hand side of an ellipse, and an abbreviation quadrant elliptical cross section where the lower part was removed and which is a configuration in drawing 16 (b) while having an abbreviation half elliptical cross section where the lower half of an ellipse was removed in drawing 16 (a) and which is a configuration. That is, the above-mentioned mould resin 139 makes the shape of dome shape in which the field except the optical outgoing radiation side A has predetermined radius of curvature in a printed-circuit board 18 top. And the curved-surface part of the lateral surface of this mould resin 139 is covered, fluorescent substance layer 12a as a fluorescent substance is formed, and the reflector 20 for reflecting the light from semi-conductor light emitting device 7c in that lateral surface further is formed.

[0164] Furthermore, the obstruction object 21 as a screen intercepted so that light from semi-conductor light emitting device 7c may not be directly taken out to the exterior is formed in the optical outgoing radiation side A side of semi-conductor light emitting device 7c on a printed-circuit board 18. This obstruction object 21 is seen from the luminescence side A side of semi-conductor luminescence equipment 94 (refer to drawing 16 (a)), it has the height and width of face which interrupt the luminescence field of semi-conductor light emitting device 7c, and an opaque resin metallurgy group etc. is used to the light of semi-conductor light emitting device 7c. Moreover, although the ingredient which absorbs light as an ingredient of the obstruction object 21 may be used, the utilization effectiveness of light worsens in that case. Moreover, as a broken line shows, obstruction object 21a which consists of a resin frame surrounding the surroundings of semi-conductor light emitting device 7c may be used for drawing 16 (b). Moreover, in order to interrupt the light by which direct outgoing radiation is carried out from above-mentioned semi-conductor light emitting device 7c, a crevice may be formed in some thicker printed-circuit boards, and a semi-conductor light emitting device may be arranged so that a luminescence field may hide in this crevice. Since the luminescence field of a semi-conductor light emitting device is located caudad, it can make the height of an obstruction object low, and its utilization effectiveness of light is large while it can miss the heat from a luminescence field quickly to the exterior through a submounting leadframe, since semi-conductor light emitting device 7c connects and carries a semi-conductor laminating side in the immediate printing wiring substrate 18. In addition, it is also possible to use for the semi-conductor luminescence equipment of the 7th operation gestalt which showed above-mentioned Screens 21 and 21a and an above-mentioned crevice to drawing 14 (a) and (b).

[0165] It is reflected by the reflector 20 which touches this fluorescent substance layer 12a after wavelength conversion is carried out by the above-mentioned fluorescent substance layer 12a, and after wavelength conversion is again carried out by fluorescent substance layer 12a, outgoing radiation of the outgoing radiation light from above-mentioned semi-conductor light emitting device 7c is carried out to the semi-conductor luminescence equipment exterior. Therefore, compared with semi-conductor luminescence equipment equipped with the fluorescent substance arranged in the direction of outgoing radiation of light so that the light from a semi-conductor light emitting device may only penetrate, as for this semi-conductor luminescence equipment, it has the wavelength conversion efficiency of abbreviation two times. Therefore, since sufficient wavelength conversion effectiveness is expectable even if it makes fluorescent substance layer 12a thin, the amount of the fluorescent substance used can be reduced and the cost of semi-conductor luminescence equipment can be reduced.

[0166] Although fluorescent substance layer 12a in the above-mentioned operation gestalt made light penetrate and wavelength conversion was performed, it is nontransparent and the fluorescent substance reflected while carrying out wavelength conversion of the light may be formed as a reflector. For example, the fluorescent substance which applied the fluorescence ingredient to the front face with the property to reflect and scatter light of a very fine particle can be considered.

[0167] In addition, in this operation gestalt, the semi-conductor light emitting devices 7a and 7b which change to semi-conductor light emitting device 7c, and are shown in drawing 1 (a) and (b) may be used. Since especially the semi-conductor light emitting device 7 (b) that has a conductive substrate has the same electrode structure as the semi-conductor light emitting device of the conventional GaAs system which has an electrode in a vertical both-sides side, or a GaP system, it can use the conventional leadframe as it is.

[0168] (10th operation gestalt) Drawing 17 (a) and (b) are the sectional views showing the side luminescence mold semi-conductor luminescence equipment as 10th operation gestalt of this invention.

[0169] Drawing 17 (a) shows the sectional view which looked at the above-mentioned semi-conductor luminescence equipment from luminescence, and drawing 17 (b) is the sectional view seen from the right angle to the luminescence direction. The point that this operation gestalt differs from the 9th operation gestalt shown in drawing 16 (a) and (b) The point using semi-conductor light emitting device 7b which changes to semi-conductor light emitting device 7c, and has a conductive substrate, It is a point using printed-circuit board 18a as a base which comes to equip the ultra-thin mold printed-circuit board 23 which changed to the printed-circuit board 18, became the base of the glass epoxy group plate which has a through hole B from the metallic foil, and was equipped with an electrode-cum-wiring.

[0170] As shown in drawing 17 (a) and (b), this side luminescence mold semi-conductor luminescence equipment is installed on the above-mentioned ultra-thin printed-circuit board 23 so that semi-conductor light emitting device 7b may be hidden in the breakthrough B of printed-circuit board 18a. Therefore, since the luminescence field of semi-conductor light emitting device 7b hides thoroughly from the outside while thin shape-ization of semi-conductor luminescence equipment is attained, since the height of semi-conductor light emitting device 7b is absorbable by the thickness of printed-circuit board 18a, the light by which outgoing radiation is carried out does not come out of semi-conductor light emitting device 7b outside directly. That is, since outgoing radiation only of the light from

which wavelength was changed by fluorescent substance layer 12a as a fluorescent substance is carried out to the exterior of semi-conductor luminescence equipment, the color tone of semi-conductor luminescence equipment becomes still better. In addition, the depth of the above-mentioned breakthrough B should just be extent in which the luminescence field of semi-conductor light emitting device 7b sees and hides from the outgoing radiation side A (refer to drawing 17 (b)) side of light at least.

[0171] In addition, in the above-mentioned operation gestalt, the semi-conductor light emitting devices 7a and 7c shown in drawing 1 (a) and (c) may be used for semi-conductor light emitting device 7b. Since a luminescence field is located near the pars basilaris ossis occipitalis of a through hole B when it has arranged in Breakthrough B, semi-conductor luminescence equipment is further made especially as for the above-mentioned semi-conductor light emitting device 7c to a thin shape.

[0172] (11th operation gestalt) Drawing 18 (a), (b), (c) and drawing 19 (a), (b), and (c) are drawings having shown the wavelength distribution of light in which the semi-conductor luminescence equipment of the 11th operation gestalt of this invention carries out outgoing radiation. This semi-conductor luminescence equipment is equipped with a semi-conductor light emitting device on a base, and the outgoing radiation light of this semi-conductor light emitting device has the peak of luminescence wavelength in 410nm of a wavelength field (390nm thru/or 420nm). Furthermore, this semi-conductor luminescence equipment is equipped with the 1st, 2nd, and 3rd fluorescent substance which changes the outgoing radiation light of the above-mentioned semi-conductor light emitting device. The above-mentioned semi-conductor light emitting device is closed by the closure resin which consists of resin which is not damaged by this semi-conductor light emitting device, and after the 1st, 2nd, and 3rd fluorescent substance of the above has been mixed by abbreviation homogeneity, it is contained in this closure resin. The 1st fluorescent substance of the above consists of a fluorescent substance of 0.5MgF2 and 3.5 MgO-GeO2:Mn, it is excited by the outgoing radiation light of the above-mentioned semi-conductor light emitting device, and luminescence wavelength carries out outgoing radiation of the red light which has the main peak in 658nm. The 2nd fluorescent substance of the above consists of a fluorescent substance of SrAl2O4:Eu, and luminescence wavelength carries out outgoing radiation of the green light which has the main peak in 522nm. The 3rd fluorescent substance of the above consists of a fluorescent substance of BaMgAl10O17:Eu, and luminescence wavelength carries out outgoing radiation of the blue light which has the main peak in 452nm. By carrying out color mixture of the outgoing radiation light from the 1st, 2nd, and 3rd fluorescent substance of the above, this semi-conductor luminescence equipment carries out outgoing radiation of the white light, and is used as the light source for back lights of indicating equipments, such as a cellular phone, and a Personal Digital Assistant, a personal computer. In addition, although it is in a wavelength field (390nm thru/or 420nm), if the peak of the luminescence wavelength of the above-mentioned semi-conductor light emitting device is in a wavelength field (400nm thru/or 420nm), it is more desirable.

[0173] In the above-mentioned semi-conductor luminescence equipment, drawing 18 (a), (b), and (c) are drawings having shown change produced in wavelength distribution of outgoing radiation light, when the mixed ratio of the 1st, 2nd, and 3rd fluorescent substance of the above is changed. An axis of abscissa is wavelength (nm) and all of an axis of ordinate are relative intensity (%). Moreover, also in any, the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance of the above to the weight of the above-mentioned closure resin is 0.5.

[0174] Drawing 18 (a) is drawing in which the 1st fluorescent substance showed wavelength distribution of the outgoing radiation light by semi-conductor luminescence equipment in case 47 % of the weight and the 2nd fluorescent substance are [13 % of the weight and the 3rd fluorescent substance] 40 % of the weight noting that the total amount of the 1st, 2nd, and 3rd fluorescent substance is 100 % of the weight. The outgoing radiation light of the semi-conductor luminescence equipment in this case becomes the white of the color tone which green cut a little.

[0175] Drawing 18 (b) is drawing in which the 1st fluorescent substance showed wavelength distribution of the outgoing radiation light by semi-conductor luminescence equipment in case 56 % of the weight and the 2nd fluorescent substance are [11 % of the weight and the 3rd fluorescent substance] 33 % of the weight noting that the total amount of the 1st, 2nd, and 3rd fluorescent substance is 100 % of the weight. The outgoing radiation light of the semi-conductor luminescence equipment in this case becomes the white of a good color tone.

[0176] Drawing 18 (c) is drawing in which the 1st fluorescent substance showed wavelength distribution of the outgoing radiation light by semi-conductor luminescence equipment in case 65 % of the weight and the 2nd fluorescent substance are [26 % of the weight and the 3rd fluorescent substance] 9 % of the weight noting that the total amount of the 1st, 2nd, and 3rd fluorescent substance is 100 % of the weight. The outgoing radiation light of the semi-conductor luminescence equipment in this case becomes the white of the color tone which red cut a little, and the so-called daytime white.

[0177] moreover, La2O2 S:Eu as the 1st fluorescent substance and BaMg2aluminum16O27: as the 2nd fluorescent substance — the semi-conductor luminescence equipment equipped with Eu, Mn, and 10(Sr, calcium, Mg, Ce) (PO4) 6Cl2:Eu as the 3rd fluorescent substance in order at 72 % of the weight, 7 % of the weight, and 21% of the weight of a rate was formed. The outgoing radiation light of this semi-conductor luminescence equipment was the good white light. Furthermore, a white outgoing radiation light also with the good semi-conductor luminescence equipment equipped with the 1st, 2nd, and 3rd fluorescent substance of the above in order at 58 % of the weight, 22 % of the weight, and 20% of the weight of a rate was obtained. While becoming the white of the color tone which green cut when the above experimental result was taken into consideration, and the luminescent color of the above-mentioned semi-conductor luminescence equipment had few mixed ratios of the 1st fluorescent substance, i.e., the

fluorescent substance of red luminescence, than 50 % of the weight, when there were more mixed ratios of the 1st fluorescent substance of the above than 70 % of the weight, it turned out that it becomes the white of the color tone which red cut. Moreover, it turned out that the luminescent color of the above-mentioned semi-conductor luminescence equipment turns into white of the color tone which red cut when there were few mixed ratios of the 2nd fluorescent substance, i.e., the fluorescent substance of green luminescence, than 7 % of the weight, and it will become the white of the color tone which green cut if there are more mixed ratios of the 2nd fluorescent substance of the above than 20 % of the weight. Moreover, it turned out that the luminescent color of the above-mentioned semi-conductor luminescence equipment turns into white of the color tone which red cut when there were few mixed ratios of the 3rd fluorescent substance, i.e., the fluorescent substance of blue luminescence, than 20 % of the weight, and it will become the white of the color tone which green cut if there are more mixed ratios of the 3rd fluorescent substance of the above than 30 % of the weight. therefore, the case where the ratio of the AUW of the 1st [as opposed to the weight of closure resin in the semi-conductor luminescence equipment of the 11th operation gestalt] thru/or the 3rd fluorescent substance is 0.5 — the 1st, 2nd, and 3rd fluorescent substance — 56 % of the weight of each, 11 % of the weight, and 33% of the weight of a mixing ratio — a good white outgoing radiation light is obtained with it being a rate.

[0178] In the above-mentioned semi-conductor luminescence equipment, drawing 19 (a), (b), and (c) are drawings having shown change produced in wavelength distribution of outgoing radiation light, when the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance to the weight of closure resin is changed. An axis of abscissa is wavelength (nm) and all of an axis of ordinate are relative intensity (%). Moreover, also in any, for the 1st fluorescent substance, the 2nd fluorescent substance is [the 3rd fluorescent substance] 9% of the weight of a mixed ratio 26% of the weight 65% of the weight noting that the total amount of the 1st, 2nd, and 3rd fluorescent substance is 100 % of the weight.

[0179] Drawing 19 (a) is drawing having shown wavelength distribution of the outgoing radiation light by semi-conductor luminescence equipment in case the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance to the weight of closure resin is 0.5. The outgoing radiation light of this semi-conductor luminescence equipment becomes the white of the color tone which red cut a little, and the so-called daytime white.

[0180] Drawing 19 (b) is drawing having shown wavelength distribution of the outgoing radiation light by semi-conductor luminescence equipment in case the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance to the weight of closure resin is 0.66. The outgoing radiation light of this semi-conductor luminescence equipment becomes the white of a good color tone.

[0181] Drawing 19 (c) is drawing having shown wavelength distribution of the outgoing radiation light by semi-conductor luminescence equipment in case the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance to the weight of closure resin is 1.0. The outgoing radiation light of this semi-conductor luminescence equipment becomes the white of the color tone which green cut a little.

[0182] Drawing 19 (a), (b), and (c) show that a white outgoing radiation light of a color tone with the above-mentioned semi-conductor luminescence equipment good when the 1st, 2nd, and 3rd fluorescent substance of the above is 65 % of the weight, 26 % of the weight, and 9 % of the weight respectively and the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance to the weight of closure resin is 1.0 or less [0.5 or more] is obtained.

[0183] Drawing 20 is drawing showing the emission spectrum 150 of the semi-conductor luminescence equipment shown in drawing 19 (a), and the effective emission spectrum 152 of the semi-conductor luminescence equipment in consideration of human being's relative luminous efficiency 151. An axis of abscissa is wavelength (nm) and an axis of ordinate is relative intensity (%).

[0184] Since it has a larger luminescence wavelength field than the wavelength field which human being's relative luminous efficiency 151 has and the effective emission spectrum 152 of the wavelength field which covers the wavelength field of the above-mentioned relative luminous efficiency 151 is obtained, in human being's vision, a color tone is made as for the emission spectrum 150 of the above-mentioned semi-conductor luminescence equipment to the good white luminescent color, so that drawing 20 may show.

[0185] Furthermore, since the above-mentioned semi-conductor luminescence equipment is resin which the above-mentioned closure resin does not damage by the outgoing radiation light from a semi-conductor light emitting device, inconvenience, such as melanism, does not produce this closure resin. Therefore, inconvenience, such as lowering of the brightness of semi-conductor luminescence equipment, can be prevented, it continues at a long period of time, and the engine performance of semi-conductor luminescence equipment is made to stability.

[0186] In the above-mentioned semi-conductor luminescence equipment, the wavelength field range of human being's relative luminous efficiency 151, abbreviation, etc. may spread and carry out the wavelength field of the above-mentioned effective emission spectrum 152 by using two or more fluorescent substances of a class for the 1st, 2nd, and 3rd fluorescent substance of the above respectively. Since the luminescence wavelength field of semi-conductor luminescence equipment is made by this only in human being's visible region while being able to make good the color tone of the luminescent color of semi-conductor luminescence equipment, the luminous efficiency of semi-conductor luminescence equipment can be improved.

[0187] Although the semi-conductor luminescence equipment of this operation gestalt mixed the 1st, 2nd, and 3rd fluorescent substance of the above at abbreviation homogeneity to the closure resin which closes a semi-conductor light emitting device Only the 1st, 2nd, and 3rd fluorescent substance of the above may be mixed, and this mixed fluorescent substance may be arranged in the shape of a layer on the front face of closure resin, and the 1st, 2nd, and 3rd fluorescent substance of the above may be respectively prepared in the front face of the above-mentioned

closure resin in the shape of a layer separately. In this case, it is desirable to arrange in consideration of luminescence / absorption wavelength of light etc. toward a side far from the side near a semi-conductor light emitting device in order with the short luminescence wavelength of the fluorescent substance with which that layer contains each layer. Moreover, the semiconductor device of this operation gestalt may be formed in the same structure as the semi-conductor luminescence equipment of the above 1st thru/or the operation gestalt of 10. By this, white luminescence of a good color tone can be obtained in the semi-conductor luminescence equipment of a ramp type, a chip mold, and a side luminescence mold.

[0188] (12th operation gestalt) Drawing 21 is the mimetic diagram showing the luminescence display of the 12th operation gestalt of this invention. This luminescence display 200 is a liquid crystal display which has the light source 201 which consists of semi-conductor luminescence equipment of the operation gestalt of the above 11th, the light guide plate 202 to which the light 205 from the light source 201 is led, and the liquid crystal panel 203 equipped with the light filter which carries out the spectrum of the light from this light guide plate 202.

[0189] The above-mentioned light source 201 may be formed using any of the semi-conductor luminescence equipment of the above 1st thru/or the operation gestalt of 11. Especially when the above-mentioned luminescence display 200 is used as displays, such as a cellular phone, and a Personal Digital Assistant, a personal computer, the semi-conductor luminescence equipment of white luminescence of the operation gestalt of the above 11th is suitable as the light source 201. Moreover, if the 1st, 2nd, and 3rd fluorescent substance with which the semi-conductor luminescence equipment of the operation gestalt of the above 11th is equipped is used as a fluorescent substance of the semi-conductor luminescence equipment of the above 4th thru/or the operation gestalt of 6, it will have a chip part shape and the semi-conductor luminescence equipment for which light can be emitted white will be obtained. Since this semi-conductor luminescence equipment has a chip part shape, the handling at the time of mounting in the luminescence display 200 becomes easy. Moreover, since the semi-conductor luminescence equipment which has the above-mentioned chip part shape can be attached to side-face 202a of the above-mentioned light guide plate 202 direct picking, it can lead luminescence light to a light guide plate 202 efficiently. Moreover, if the light source 201 is constituted using the semi-conductor luminescence equipment carrying the fluorescent substance of the 11th operation gestalt to the semi-conductor luminescence equipment of the above 7th thru/or the operation gestalt of 10 Since this semi-conductor luminescence equipment is a side luminescence mold, so that the printed-circuit board 18 as a base may turn into a light guide plate 202 to abbreviation parallel By attaching semi-conductor luminescence equipment in side-face 202a of a light guide plate, thickness of the luminescence display 200 of the direction of optical outgoing radiation of this light guide plate 202 can be effectively made small. In addition, although two or more semi-conductor luminescence equipments were used for it, as long as the above-mentioned light source 201 has enough luminous intensity, one semi-conductor luminescence equipment may constitute it.

[0190] The above-mentioned light guide plate 202 is formed from a polycarbonate, acrylic resin, etc. Moreover, if the light reflex section is prepared in fields other than side-face 202a into which the light from the light source 201 is introduced, and light emission side 202b which emits the introduced light, the light from the light source 201 can be efficiently emitted from light emission side 202b. Moreover, you may introduce from two side faces which the light to a light guide plate 202 is not only from one side-face 202a, for example, counter, or may introduce from three and four side faces. Furthermore, in order to make bleedoff luminous intensity in light emission side 202b into homogeneity, a light-scattering agent may be mixed into a light guide plate 202, or the field by the side of the bottom in the above-mentioned light emission side 202b and drawing 21 which counters may be made to incline, the light introduced from side-face 202a of a light guide plate may be reflected on the above-mentioned bottom side face in which dip was carried out, and you may emit from light emission side 202b. If a light-scattering pattern is prepared in the above-mentioned bottom side face, reinforcement of the light 206 from light emission side 202b will be further made to homogeneity.

[0191] The above-mentioned liquid crystal panel 203 is equipped with the light filter stuck on the liquid crystal enclosed between two transparent substrates which prepared the transparent electrode, and these two substrates, the polarizing plate, and the above-mentioned substrate. Corresponding to two or more pixels by which the quantity of light which penetrates the above-mentioned liquid crystal is adjusted, red and a green and blue light filter are formed in the above-mentioned light filter by the signal impressed to the above-mentioned transparent electrode. It is a color or a pigment of light transmission nature etc., and it is colored red, green, and blue and red and a green and blue light filter are formed so that this light filter may make the pixel of a minute honeycomb configuration or a delta array configuration to a polycarbonate, polyethylene terephthalate, etc. which were formed in the shape of a sheet.

[0192] Drawing 22 is drawing having shown the spectral characteristic of the above-mentioned light filter, 210 is the spectral characteristic of a red light filter, and 212 is [211 is the spectral characteristic of a green light filter, and] the spectral characteristic of a blue light filter. Wavelength distribution of the light from the above-mentioned light source 201 is adjusted so that the spectral characteristic 210,211,212 of this light filter may be suited. In more detail, in the semi-conductor luminescence equipment which constitutes the light source 201, the luminescence wavelength of a semi-conductor light emitting device, the luminescence wavelength of the 1st, 2nd, and 2nd fluorescent substance and a mixed ratio, the rate of a compounding ratio of the AUW of the fluorescent substance of the 1st thru/or 3 and the weight of the resin for closure, etc. are adjusted, and wavelength distribution of the light 205 from the light source 201 is fitted to the spectral characteristic 210,211,212 of the above-mentioned light filter. For example, the semi-conductor luminescence equipment which has a good color tone and makes wavelength

distribution of drawing 19 (b) conforms to the spectral characteristic of drawing 22 . This semi-conductor luminescence equipment is because the above 1st thru/or the rate of a compounding ratio of the AUW of the fluorescent substance of 3 and the weight of the resin for closure are adjusted so that the above-mentioned spectral characteristic may be suited. Thus, since the above-mentioned light source 201 has the wavelength distribution which suits the spectral characteristic of the above-mentioned light filter, if the light 205 from this light source 201 is led to a liquid crystal panel 203 through the above-mentioned light guide plate 202, with the light filter of this liquid crystal panel 203, its brightness will be high and a spectrum will be carried out to the red of an abbreviation single, and the green and blue light 207. Consequently, a deer with a color tone good [this luminescence display 200] can also display the image and image of high brightness and high contrast.

[0193]

[Effect of the Invention] So that clearly as mentioned above, the semi-conductor luminescence equipment of this invention While having the outgoing radiation light of 390nm thru/or a short wavelength field with human being's visibility very low at 420nm, luminescence wavelength the above-mentioned semi-conductor light emitting device Since it has the fluorescent substance which changes the outgoing radiation light from this semi-conductor light emitting device into red (600nm thru/or 670nm) of luminescence wavelength, the light from this fluorescent substance Seemingly, if human being's visibility is taken into consideration, since a color tone hardly changes by the direct light from the above-mentioned semi-conductor light emitting device, this semi-conductor luminescence equipment has a good color tone, and light can be emitted in the light of monochrome red. Moreover, since the luminescence wavelength of the above-mentioned semi-conductor light emitting device is 390nm thru/or 420nm, breakage on the components which constitute the above-mentioned semi-conductor luminescence equipment, and the adverse effect to the body can be prevented effectively.

[0194] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance M2O2 S:Eu (however, any one or two or more elements with which M is chosen from La, Gd, and Y), since it consists of any one or 2 or more 0.5MgF2 and 3.5 MgO-GeO2:Mn, Y2O3:Eu, Y(P, V) O4:Eu, YVO4:Eu, and among the groups of a fluorescent substance come out of and expressed The optimal fluorescent substance can be chosen according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of monochrome red luminescence of a good color tone can be obtained, and utilization effectiveness of the light of a semi-conductor light emitting device is made to high semi-conductor luminescence equipment combining two or more fluorescent substances.

[0195] While having the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, the semi-conductor luminescence equipment of this invention the above-mentioned semi-conductor light emitting device Since it has the fluorescent substance which changes the outgoing radiation light from this semi-conductor light emitting device into the green luminescence wavelength of 500nm thru/or 540nm, the light from this fluorescent substance Seemingly, if human being's visibility is taken into consideration, since a color tone hardly changes by the direct light from the above-mentioned semi-conductor light emitting device, this semi-conductor luminescence equipment has a good color tone, and light can be emitted in the light of monochrome green. Moreover, since the luminescence wavelength of the above-mentioned semi-conductor light emitting device is 390nm thru/or 420nm, breakage on the components which constitute the above-mentioned semi-conductor luminescence equipment, and the adverse effect to the body can be prevented effectively.

[0196] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance RMg2aluminum16O27: — Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) — RMgAl10O17: — Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) — It Eu(s) and D(ies). ZnS:Cu, SrAl2O4:Eu, and SrAl2O4: — ZnO:Zn, Zn2germanium2O4:Mn, Zn2SiO4:Mn, and Q3MgSi2O8:Eu — Mn since it consists of any one or 2 or more however, (any one or two or more elements) with which Q is chosen from Sr, Ba, and calcium, and among the groups of a fluorescent substance come out of and expressed The optimal fluorescent substance can be chosen according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of green monochrome luminescence can be obtained, and utilization effectiveness of the light of a semi-conductor light emitting device is made to high semi-conductor luminescence equipment combining two or more fluorescent substances.

[0197] The semi-conductor luminescence equipment of this invention the above-mentioned semi-conductor light emitting device Since it has the fluorescent substance which changes the outgoing radiation light from this semi-conductor light emitting device into the blue luminescence wavelength of 410nm thru/or 480nm while having the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm Seemingly, if the light from this fluorescent substance takes human being's visibility into consideration, since a color tone hardly changes by the direct light from the above-mentioned semi-conductor light emitting device, this semi-conductor luminescence equipment has a good color tone, and light can be emitted in the light of monochrome blue. Moreover, since the luminescence wavelength of the above-mentioned semi-conductor light emitting device is 390nm thru/or 420nm, breakage on the components which constitute the above-mentioned semi-conductor luminescence equipment, and the adverse effect to the body can be prevented effectively.

[0198] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance A10(PO4) 6Cl2:Eu (however, any one or two or more elements with which A is chosen from Sr, calcium, Ba, Mg, and Ce), XMg2aluminum16O27:Eu (however, any one as which X is chosen from Sr and Ba or both elements), XMgAl10O17:Eu (however, any one as which X is chosen from Sr and Ba or both elements), ZnS:Ag, Sr10

(PO4) 6Cl2:Eu, calcium10(PO4) 6F2:Sb, Z3MgSi2O8:Eu (however, any one or two or more elements with which Z is chosen from Sr, Ba, and calcium), SrMgSi2O8:Eu, Sr2P2O7:Eu, and CaAl2O4:, since it consists of any one or 2 or more Eu, Nd, and among the groups of a fluorescent substance come out of and expressed The optimal fluorescent substance can be chosen according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of blue monochrome luminescence can be obtained, and utilization effectiveness of the light of a semi-conductor light emitting device is made to high semi-conductor luminescence equipment combining two or more fluorescent substances.

[0199] The semi-conductor luminescence equipment of this invention the above-mentioned semi-conductor light emitting device Since it has the fluorescent substance which changes the outgoing radiation light from this semi-conductor light emitting device into with a bluish green color (480nm thru/or 500nm) luminescence wavelength while having the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm Seemingly, if the light from this fluorescent substance takes human being's visibility into consideration, since a color tone hardly changes by the direct light from the above-mentioned semi-conductor light emitting device, this semi-conductor luminescence equipment has a good color tone, and light can be emitted in the light of a monochrome bluish green color. Moreover, since the luminescence wavelength of the above-mentioned semi-conductor light emitting device is 390nm thru/or 420nm, breakage on the components which constitute the above-mentioned semi-conductor luminescence equipment, and the adverse effect to the body can be prevented effectively.

[0200] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance It Eu(s) and D(ies). Sr4aluminum14O25:Eu and Sr4aluminum14O25: — L10(PO4) 6Cl2:Eu (however, any one or two or more elements with which L is chosen from Ba, calcium, and Mg), since it consists of any one or 2 or more Sr2Si3O8 and 2SrCl2:Eu, and among the groups of a fluorescent substance come out of and expressed The optimal fluorescent substance can be chosen according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of bluish green color monochrome luminescence of a good color tone can be obtained, and semi-conductor luminescence equipment with the high utilization effectiveness of the light of a semi-conductor light emitting device can be obtained combining two or more fluorescent substances.

[0201] The semi-conductor luminescence equipment of this invention the above-mentioned semi-conductor light emitting device Since it has the fluorescent substance which changes the outgoing radiation light from this semi-conductor light emitting device into the orange luminescence wavelength of 570nm thru/or 600nm while having the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm If human being's visibility is taken into consideration, since the light from this fluorescent substance hardly changes a color tone by the direct light from the above-mentioned semi-conductor light emitting device, it can emit light seemingly in a monochrome orange light with a color tone good [this semi-conductor luminescence equipment]. Moreover, since the luminescence wavelength of the above-mentioned semi-conductor light emitting device is 390nm thru/or 420nm, breakage on the components which constitute the above-mentioned semi-conductor luminescence equipment, and the adverse effect to the body can be prevented effectively.

[0202] since the above-mentioned fluorescent substance consists of any one or 2 or more ZnS:Mn, ZnS:Cu, Mn and Co, and among the groups of a fluorescent substance come out of and expressed, it can choose the optimal fluorescent substance according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, and the semi-conductor luminescence equipment of 1 operation gestalt can obtain the semi-conductor luminescence equipment of orange monochrome luminescence.

[0203] Since the closure resin which closes at least the part and the above-mentioned semi-conductor light emitting device of the base which carries a semi-conductor light emitting device contains the fluorescent substance, the semi-conductor luminescence equipment of 1 operation gestalt can carry out wavelength conversion of the outgoing radiation light from a semi-conductor light emitting device certainly, and is made into efficient semi-conductor luminescence equipment. Moreover, if closure resin is formed, since a fluorescent substance can be arranged, it is not necessary to arrange a fluorescent substance separately, and manufacture of semi-conductor luminescence equipment can be made easy.

[0204] Moreover, since the above-mentioned semi-conductor luminescence equipment obtains desired luminescence wavelength when luminescence wavelength combines the semi-conductor light emitting device which has a fixed wavelength field, and the fluorescent substance which has predetermined luminescence wavelength and it can obtain the semi-conductor luminescence luminescence equipment of desired luminescence wavelength only by changing a fluorescent substance by the same production process, it can reduce the manufacturing cost of semi-conductor luminescence equipment substantially.

[0205] While the semi-conductor luminescence equipment of 1 operation gestalt arranges a semi-conductor light emitting device at the bottom of the mounting section of the cup configuration formed at the head of a leadframe Since it connects with another leadframe electrically and at least the part and the above-mentioned semi-conductor light emitting device of the two above-mentioned leadframes are closed by the above-mentioned closure resin Since wavelength conversion of the outgoing radiation light from the semi-conductor light emitting device collected in the mounting section of the above-mentioned cup configuration is certainly carried out with the fluorescent substance which the above-mentioned closure resin contains, luminous efficiency can obtain semi-conductor luminescence equipment with a good and sufficient color tone with sufficient directivity.

[0206] Since the semi-conductor luminescence equipment of 1 operation gestalt carries out direct continuation of the above-mentioned semi-conductor light emitting device to metal wiring of the insulator connected at the head of

the leadframe of a couple and is closing at least the part, the above-mentioned insulator, and the above-mentioned semi-conductor light emitting device of a leadframe of a up Norikazu pair by the above-mentioned closure resin, it can manufacture semi-conductor luminescence equipment easily rather than it connects a semi-conductor light emitting device to metal wiring by wire bonding etc.

[0207] While the semi-conductor luminescence equipment of 1 operation gestalt arranges a semi-conductor light emitting device at the bottom of the mounting section of the cup configuration formed at the head of a leadframe Since it connects with another leadframe electrically, the mounting section of the above-mentioned cup configuration is filled up with a fluorescent substance and at least the part, the above-mentioned semi-conductor light emitting device, and the above-mentioned fluorescent substance of the above-mentioned leadframe are closed by closure resin While being able to carry out the wavelength conversion of the light from a semi-conductor light emitting device certainly and being able to make it efficient semi-conductor luminescence equipment, it can do few rather than it makes closure resin contain a fluorescent substance so that in the above-mentioned operation gestalt for the amount of the above-mentioned fluorescent substance used.

[0208] While the semi-conductor luminescence equipment of 1 operation gestalt arranges a semi-conductor light emitting device at the bottom of the mounting section of the cup configuration formed at the head of a leadframe Connect with another leadframe electrically, fill up the mounting section of the above-mentioned cup configuration with a coating member, and a fluorescent substance is further arranged on the above-mentioned coating member. Since at least the part, the above-mentioned semi-conductor light emitting device, the above-mentioned coating member, and the above-mentioned fluorescent substance of the two above-mentioned leadframes are closed by closure resin, the amount of the fluorescent substance used can be made fewer than the case where all the above-mentioned mounting circles are filled up with a fluorescent substance. Moreover, since distance between the light-emitting part of the above-mentioned semi-conductor light emitting device and a fluorescent substance is made to abbreviation homogeneity by the above-mentioned coating member, there is no irregular color and light of semi-conductor luminescence equipment is made to homogeneity. Furthermore, since the above-mentioned coating member estranges the above-mentioned semi-conductor light emitting device and a fluorescent substance, electric and thermal degradation of the fluorescent substance by the semi-conductor light emitting device can be prevented.

[0209] The semi-conductor luminescence equipment of 1 operation gestalt connects with metal wiring of a substrate, and carries a semi-conductor light emitting device, and since the above-mentioned semi-conductor light emitting device is closed with the closure resin containing a fluorescent substance, it Since the semi-conductor luminescence equipment of the luminescence wavelength of the request only by only changing the class of fluorescent substance contained in the above-mentioned closure resin without changing the class of the above-mentioned semi-conductor light emitting device is obtained, the semi-conductor luminescence equipment of two or more requests can manufacture more easily than before, consequently semi-conductor luminescence equipment can manufacture to low cost.

[0210] Since the amount of the above-mentioned fluorescent substance used can be made little since it is arranged in the crevice of a substrate while connecting to metal wiring of a substrate electrically [the semi-conductor luminescence equipment of 1 operation gestalt / a semi-conductor light emitting device], and the above-mentioned crevice is filled up with the fluorescent substance, a manufacturing cost can be made cheap and wavelength conversion of the light from a semi-conductor light emitting device is moreover certainly carried out with the above-mentioned fluorescent substance, semi-conductor luminescence equipment with sufficient luminous efficiency is obtained.

[0211] Since the above-mentioned crevice is formed with the frame arranged at the above-mentioned substrate, the semi-conductor luminescence equipment of 1 operation gestalt can reduce the time and effort of processing which cuts a substrate, for example and forms a crevice. Moreover, if the field by the side of the semi-conductor light emitting device of the above-mentioned frame is processed into the configuration which condenses the outgoing radiation light from the above-mentioned semi-conductor light emitting device, the conversion efficiency of the wavelength of the above-mentioned outgoing radiation light can be improved further.

[0212] Since the semi-conductor luminescence equipment of 1 operation gestalt is arranged in the crevice of a substrate while the semi-conductor light emitting device is electrically connected to metal wiring of a substrate, and it arranges the fluorescent substance on the above-mentioned closure resin while it has filled up this crevice with closure resin, it can reduce the amount of the above-mentioned fluorescent substance used rather than it is filled up with a fluorescent substance inside the crevice of a substrate like the above-mentioned operation gestalt. Moreover, since the above-mentioned closure resin makes abbreviation homogeneity distance between the light-emitting part of a semi-conductor light emitting device, and a fluorescent substance, it can obtain luminescence of the homogeneity which does not almost have an irregular color. Moreover, since the above-mentioned closure resin makes a high order semi-conductor light emitting device and a fluorescent substance estrange, it reduces the electric and thermal effect of a semi-conductor light emitting device to the above-mentioned fluorescent substance, and the engine performance of semi-conductor luminescence equipment is made as for it to stability.

[0213] As for the semi-conductor luminescence equipment of 1 operation gestalt, a semi-conductor light emitting device is connected to metal wiring of a substrate. Since it has closure resin which the reflected light from the above-mentioned reflector penetrates and the fluorescent substance is contained in the above-mentioned closure resin while having the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device and closing the above-mentioned semi-conductor light emitting

device Since the semi-conductor luminescence equipment of desired luminescence wavelength is obtained only by changing the class of the above-mentioned fluorescent substance without changing the class of the above-mentioned semi-conductor light emitting device, semi-conductor luminescence equipment can be manufactured easily and cheaply conventionally. Moreover, since wavelength conversion of the outgoing radiation light from the above-mentioned semi-conductor light emitting device and the reflected light reflected by the above-mentioned reflector is carried out certainly, semi-conductor luminescence equipment with the sufficient utilization effectiveness of light can be obtained.

[0214] While connecting with metal wiring and the electric target of a substrate and equipping a semi-conductor light emitting device with the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of 1 operation gestalt The exterior of semi-conductor luminescence equipment is equipped with the screen which interrupts the light which carries out direct outgoing radiation from the above-mentioned semi-conductor light emitting device. Since it has closure resin which the reflected light from the above-mentioned reflector penetrates and the layer of a fluorescent substance is prepared in the field which light reflects in the above-mentioned reflector while closing the above-mentioned semi-conductor light emitting device Since wavelength conversion is carried out while the light from a semi-conductor light emitting device is surely reflected by the above-mentioned reflector, and outgoing radiation is carried out to the exterior of semi-conductor luminescence equipment, since what is necessary is to prepare a fluorescent substance only in a reflector, the amount of the fluorescent substance used can be reduced, and cheaply efficient semi-conductor luminescence equipment is obtained. Furthermore, the layer of the above-mentioned fluorescent substance is formed in the reflector of the reflector which makes a predetermined distance from a semi-conductor light emitting device, and since the distance of abbreviation homogeneity is kept and it is arranged from a semi-conductor light emitting device, it is made to the semi-conductor luminescence equipment of homogeneity luminescence without an irregular color. Furthermore, since a semi-conductor light emitting device and a fluorescent substance are estranged, it is made to electric and the semi-conductor luminescence equipment which has the engine performance which thermal effect was eased and was stabilized of the semi-conductor light emitting device to this fluorescent substance.

[0215] While connecting with metal wiring and the electric target of a substrate and equipping a semi-conductor light emitting device with the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of 1 operation gestalt A part for the light-emitting part of the above-mentioned semi-conductor light emitting device is arranged in the crevice of the above-mentioned substrate. Since it has closure resin which the reflected light from the above-mentioned reflector penetrates and the layer of a fluorescent substance is prepared in the field which light reflects in the above-mentioned reflector while closing the above-mentioned semi-conductor light emitting device Since outgoing radiation of the light from the above-mentioned semi-conductor light emitting device is carried out to the exterior of semi-conductor luminescence equipment after wavelength conversion is carried out, while surely being reflected in the exterior of semi-conductor luminescence equipment by the above-mentioned reflector, without carrying out direct outgoing radiation, a color tone is made as for it to the semi-conductor luminescence equipment which has a good outgoing radiation light.

[0216] The semi-conductor light emitting device is connected to metal wiring and the electric target of a substrate for the semi-conductor luminescence equipment of 1 operation gestalt. It has the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device. Since it has closure resin which the reflected light from the above-mentioned reflector penetrates and the layer of a fluorescent substance is prepared in the field as for which the light of the above-mentioned closure resin carries out outgoing radiation while closing the above-mentioned semi-conductor light emitting device, wavelength conversion is surely carried out and light by which outgoing radiation is carried out from semi-conductor luminescence equipment is made to the semi-conductor luminescence equipment with sufficient utilization effectiveness of light. Moreover, it is made to electric and the semi-conductor luminescence equipment which has the engine performance which could ease thermal effect and was stabilized of the semi-conductor light emitting device to the above-mentioned fluorescent substance while it is made to the semi-conductor luminescence equipment of homogeneity luminescence without an irregular color, since the layer of the above-mentioned fluorescent substance keeps the distance of abbreviation homogeneity and is arranged from a semi-conductor light emitting device.

[0217] The semi-conductor luminescence equipment of this invention carries on a base the semi-conductor light emitting device which has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm. The 1st fluorescent substance which has a red outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 600nm thru/or 670nm, The 2nd fluorescent substance which has a green outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 500nm thru/or 540nm, Equip the wavelength field whose luminescence wavelength is 410nm thru/or 480nm with the 3rd fluorescent substance which has a blue outgoing radiation light which has the main luminescence peak, and since the sum of the color of the outgoing radiation light from the 1st, 2nd, and 3rd fluorescent substance of the above is a white system the light in which the above-mentioned semi-conductor light emitting device has upwards the luminescence wavelength of the short wavelength field where human being's visibility is very low, and the fluorescent substance of each above carries out outgoing radiation the luminescent color of the white system of a good color tone can be obtained without a color tone changing with outgoing radiation light with an outgoing radiation light direct from the above-mentioned semi-conductor light emitting device from the

fluorescent substance of each above, since it is the light of red and green and blue monochrome respectively. Moreover, since color mixture of the light by which direct outgoing radiation is carried out to the semi-conductor luminescence equipment exterior is not carried out to the light from a fluorescent substance in human being's visible region from the above-mentioned semi-conductor light emitting device, even if the luminescence engine performance of a semi-conductor light emitting device falls according to secular change, it is only that the brightness of semi-conductor luminescence equipment falls, and can prevent that a color tone changes. Moreover, since the luminescence wavelength of the above-mentioned semi-conductor light emitting device is 390nm thru/or 420nm, breakage on the components which constitute the above-mentioned semi-conductor luminescence equipment, and the adverse effect to the body can be prevented effectively.

[0218] The semi-conductor luminescence equipment of 1 operation gestalt the 1st fluorescent substance of the above M2O2 S:Eu (however, any one or two or more elements with which M is chosen from La, Gd, and Y), 0.5MgF2 and 3.5 MgO-GeO2:Mn,. Y2O3:Eu, It consists of any one or 2 or more Y(P, V) O4:Eu, YVO4:Eu, and among the groups of a fluorescent substance come out of and expressed. the 2nd fluorescent substance of the above RMg2aluminum16O27: -- Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) -- RMgAl10O17: -- Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) -- It Eu(s) and D(ies). ZnS:Cu, SrAl2O4:Eu, and SrAl2O4: -- ZnO:Zn, Zn2germanium2O4:Mn, Zn2SiO4:Mn, and Q3MgSi2O8:Eu -- Mn It consists of any one or 2 or more however, (any one or two or more elements) with which Q is chosen from Sr, Ba, and calcium, and among the groups of a fluorescent substance come out of and expressed. the 3rd fluorescent substance of the above A10(PO4) 6Cl2:Eu (however, any one or two or more elements with which A is chosen from Sr, calcium, Ba, Mg, and Ce), XMg2aluminum16O27:Eu (however, any one as which X is chosen from Sr and Ba or both elements), XMgAl10O17:Eu (however, any one as which X is chosen from Sr and Ba or both elements), ZnS:Ag, Sr10(PO4) 6Cl2:Eu, calcium10(PO4) 6F2:Sb, Z3MgSi2O8:Eu (however, any one or two or more elements with which Z is chosen from Sr, Ba, and calcium), SrMgSi2O8:Eu, Sr2P2O7:Eu, and CaAl2O4:, since it consists of any one or 2 or more Eu, Nd, and among the groups of a fluorescent substance come out of and expressed Even if it uses the semi-conductor light emitting device which has which luminescence wavelength of the inside whose luminescence wavelength is 390nm thru/or 420nm By choosing a suitable fluorescent substance from two or more above-mentioned fluorescent substances corresponding to the luminescence wavelength of this semi-conductor light emitting device Since red, monochromatic green, and a monochromatic blue luminescence light can obtain respectively, the light of the white system of a good color tone can be obtained with the red of these monochrome, and the color mixture of a green and blue light. Moreover, since the light of the wavelength of all abbreviation for the luminescence wavelength of a semi-conductor light emitting device is respectively convertible for red and green and blue wavelength by forming the above-mentioned fluorescent substance combining two or more fluorescent substances, the utilization effectiveness of the outgoing radiation light of a semi-conductor light emitting device can be improved, and it is made to the semi-conductor luminescence equipment which has the luminescent color of an efficient white system.

[0219] The semi-conductor luminescence equipment of 1 operation gestalt the 1st, 2nd, and 3rd fluorescent substance of the above Since the 2nd fluorescent substance of the above is 30 or less % of the weight, the 3rd fluorescent substance of the above 20% of the weight or more 20 or less % of the weight 7% of the weight or more 70 or less % of the weight 50% of the weight or more, noting that a total amount is 100 % of the weight [the 1st fluorescent substance of the above] Since human being's visibility strengthens the luminous intensity of a low outgoing radiation light of the 1st and 3rd fluorescent substances, i.e., blue, and red compared with a green light in which the 2nd fluorescent substance of the above carries out outgoing radiation, in consideration of human being's visibility, it is made to the semi-conductor luminescence equipment which has the luminescent color of the white system of a good color tone.

[0220] The above-mentioned closure resin contains the 1st, 2nd, and 3rd fluorescent substance of the above, and the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance of the above to the weight of the above-mentioned closure resin is made as for the semi-conductor luminescence equipment of 1 operation gestalt to the or more 0.5 luminescence [semi-conductor] equipment which has the luminescent color of the white system near the natural light since it is one or less.

[0221] The light source for which the luminescence display of 1 operation gestalt used the above-mentioned semi-conductor luminescence equipment, It has the light guide plate to which the light from the above-mentioned light source is led, and the light filter of green [which are made to penetrate the light from the above-mentioned light guide plate, and carry out a spectrum / the red and green], and blue. The outgoing radiation light of the above-mentioned semi-conductor luminescence equipment Since it has the wavelength distribution which suited the spectral characteristic of the above-mentioned light filter, the outgoing radiation light of the above-mentioned semi-conductor luminescence equipment is the monochrome of red, green, and blue, and since it can carry out a spectrum to the light of comparatively large reinforcement, its utilization effectiveness of light is good and is made as for it to the luminescence display of high brightness.

[0222] The luminescence display of 1 operation gestalt so that wavelength distribution of the outgoing radiation light of semi-conductor luminescence equipment may suit the spectral characteristic of the above-mentioned light filter. The luminescence wavelength of the above-mentioned semi-conductor light emitting device, and the luminescence wavelength of the 1st fluorescent substance of the above, The luminescence wavelength of the 2nd fluorescent substance of the above, the luminescence wavelength of the 3rd fluorescent substance of the above, and the mixed ratio of the 1st, 2nd, and 3rd fluorescent substance of the above, Since at least one of the ratios of the AUW of the

1st, 2nd, and 3rd fluorescent substance of the above to the weight of the above-mentioned closure resin was adjusted With the above-mentioned light filter, since the spectrum of the light from the above-mentioned semiconductor luminescence equipment can be certainly carried out to the monochrome of red, green, and blue, and the light of comparatively high reinforcement, the above-mentioned luminescence display does not have a color omission etc., and the full color display of high brightness and high contrast can do it.

[0223] Since the above-mentioned luminescence display is a liquid crystal display, the luminescence display of 1 operation gestalt does not almost have a color omission, and the liquid crystal display of high brightness and high contrast is obtained.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention] This invention The light sources for back lights, such as a liquid crystal display, and a cellular phone, a Personal Digital Assistant, the indicator of the LED (light emitting diode) indicating equipment used for an announcement indoor outside etc., and an each kind pocket device -- It is a thing about the semi-conductor luminescence equipment used for the light source for an illumination switch and OA (office automation) devices etc. Especially, wavelength conversion of the outgoing radiation light from a semi-conductor light emitting device is carried out using a fluorescent substance, and it is related with semi-conductor luminescence equipment available as the light source of various luminescent color, and the luminescence display using it.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Semi-conductor luminescence equipment is small, and since power consumption can carry out high brightness luminescence to stability few, it is widely used as the light source in various displays. Moreover, semi-conductor luminescence equipment is used also as the light source for information record reading in various information processors. Green high brightness luminescence was possible for the semi-conductor light emitting device used for the long wavelength light semi-conductor luminescence equipment put in practical use widely until now from red by a semiconductor material, formation conditions, etc. of a luminous layer which are used. On the other hand, from blue, the semi-conductor light emitting device which emits light in the purple short wavelength light is developed, and, generally it is beginning to be put in practical use in recent years.

[0003] The LED display using the semi-conductor luminescence equipment which has the luminescent color of R (red), G (green), and B (blue) in three primary colors has begun to appear in the commercial scene, using the semi-conductor luminescence equipment of these various luminescent color.

[0004] Furthermore, the semi-conductor luminescence equipment which obtains white from blue combining the semi-conductor light emitting device and fluorescent substance which emit light in the purple short wavelength light with color mixture with the conversion light by which wavelength conversion was carried out with the outgoing radiation light and the fluorescent substance of a semi-conductor light emitting device is indicated by patent No. 2927279.

[0005] Moreover, in order to obtain the compact white luminescent color by high brightness, the semi-conductor luminescence equipment which combined the semi-conductor light emitting device which has the luminescent color of blue or a purple-blue color, and one sort or two kinds or more of fluorescent substances which absorb the light from this semi-conductor light emitting device, and emit light in the light of a visible region is indicated by JP,10-163535,A. The above-mentioned fluorescent substance is chosen so that the luminescent color of the above-mentioned semi-conductor light emitting device and the luminescent color of a fluorescent substance may become the relation of the complementary color mutually, the luminescent color of this semi-conductor light emitting device and the luminescent color of a fluorescent substance may be added and light may be emitted white.

[0006] Moreover, the semi-conductor luminescence equipment which equips JP,10-12925,A with the semi-conductor light emitting device which carries out outgoing radiation of ultraviolet radiation and the near-ultraviolet light, and the fluorescent substance which emits fluorescence by the light from this semi-conductor light emitting device is indicated. The above-mentioned semi-conductor light emitting device is a semi-conductor light emitting device which usually emits a blue light, and carries out outgoing radiation of ultraviolet radiation and the near-ultraviolet light by passing a pulse-like high current. Obtaining two or more luminescent color, using the semi-conductor light emitting device of a single class only by changing the class of the above-mentioned fluorescent substance is indicated.

[0007] Moreover, the display equipped with red, blue, and three kinds of fluorescent substance layers that emit light respectively in the green three primary colors dot-matrix type is indicated by JP,9-153644,A by receiving the ultraviolet rays from the luminous layer which is formed using 3 group nitrogen ghost semi-conductor, and emits light in the ultraviolet rays whose peak wavelength is 380nm, and this luminous layer.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] So that clearly as mentioned above, the semi-conductor luminescence equipment of this invention While having the outgoing radiation light of 390nm thru/or a short wavelength field with human being's visibility very low at 420nm, luminescence wavelength the above-mentioned semi-conductor light emitting device Since it has the fluorescent substance which changes the outgoing radiation light from this semi-conductor light emitting device into red (600nm thru/or 670nm) of luminescence wavelength, the light from this fluorescent substance Seemingly, if human being's visibility is taken into consideration, since a color tone hardly changes by the direct light from the above-mentioned semi-conductor light emitting device, this semi-conductor luminescence equipment has a good color tone, and light can be emitted in the light of monochrome red. Moreover, since the luminescence wavelength of the above-mentioned semi-conductor light emitting device is 390nm thru/or 420nm, breakage on the components which constitute the above-mentioned semi-conductor luminescence equipment, and the adverse effect to the body can be prevented effectively.

[0194] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance M2O2 S:Eu (however, any one or two or more elements with which M is chosen from La, Gd, and Y), since it consists of any one or 2 or more 0.5MgF2 and 3.5 MgO-GeO2:Mn, Y2O3:Eu, Y(P, V) O4:Eu, YVO4:Eu, and among the groups of a fluorescent substance come out of and expressed The optimal fluorescent substance can be chosen according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of monochrome red luminescence of a good color tone can be obtained, and utilization effectiveness of the light of a semi-conductor light emitting device is made to high semi-conductor luminescence equipment combining two or more fluorescent substances.

[0195] While having the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, the semi-conductor luminescence equipment of this invention the above-mentioned semi-conductor light emitting device Since it has the fluorescent substance which changes the outgoing radiation light from this semi-conductor light emitting device into the green luminescence wavelength of 500nm thru/or 540nm, the light from this fluorescent substance Seemingly, if human being's visibility is taken into consideration, since a color tone hardly changes by the direct light from the above-mentioned semi-conductor light emitting device, this semi-conductor luminescence equipment has a good color tone, and light can be emitted in the light of monochrome green. Moreover, since the luminescence wavelength of the above-mentioned semi-conductor light emitting device is 390nm thru/or 420nm, breakage on the components which constitute the above-mentioned semi-conductor luminescence equipment, and the adverse effect to the body can be prevented effectively.

[0196] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance RMg2aluminum16O27: — Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) — RMgAl10O17: — Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) — It Eu(s) and D(ies). ZnS:Cu, SrAl2O4:Eu, and SrAl2O4: — ZnO:Zn, Zn2germanium2O4:Mn, Zn2SiO4:Mn, and Q3MgSi2O8:Eu — Mn since it consists of any one or 2 or more however, (any one or two or more elements) with which Q is chosen from Sr, Ba, and calcium, and among the groups of a fluorescent substance come out of and expressed The optimal fluorescent substance can be chosen according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of green monochrome luminescence can be obtained, and utilization effectiveness of the light of a semi-conductor light emitting device is made to high semi-conductor luminescence equipment combining two or more fluorescent substances.

[0197] The semi-conductor luminescence equipment of this invention the above-mentioned semi-conductor light emitting device Since it has the fluorescent substance which changes the outgoing radiation light from this semi-conductor light emitting device into the blue luminescence wavelength of 410nm thru/or 480nm while having the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm Seemingly, if the light from this fluorescent substance takes human being's visibility into consideration, since a color tone hardly changes by the direct light from the above-mentioned semi-conductor light emitting device, this semi-conductor luminescence equipment has a good color tone, and light can be emitted in the light of monochrome blue. Moreover, since the luminescence wavelength of the above-mentioned semi-conductor light emitting device is 390nm thru/or 420nm, breakage on the components which constitute the above-mentioned semi-conductor luminescence equipment, and the adverse effect to the body can be prevented effectively.

[0198] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance A10(PO4) 6Cl2:Eu (however, any one or two or more elements with which A is chosen from Sr, calcium,

Ba, Mg, and Ce), XMg2aluminum16O27:Eu (however, any one as which X is chosen from Sr and Ba or both elements), XMgAl10O17:Eu (however, any one as which X is chosen from Sr and Ba or both elements), ZnS:Ag, Sr10 (PO4) 6Cl2:Eu, calcium10(PO4) 6F2:Sb, Z3MgSi2O8:Eu (however, any one or two or more elements with which Z is chosen from Sr, Ba, and calcium), SrMgSi2O8:Eu, Sr2P2O7:Eu, and CaAl2O4:, since it consists of any one or 2 or more Eu, Nd, and among the groups of a fluorescent substance come out of and expressed The optimal fluorescent substance can be chosen according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of blue monochrome luminescence can be obtained, and utilization effectiveness of the light of a semi-conductor light emitting device is made to high semi-conductor luminescence equipment combining two or more fluorescent substances.

[0199] The semi-conductor luminescence equipment of this invention the above-mentioned semi-conductor light emitting device Since it has the fluorescent substance which changes the outgoing radiation light from this semi-conductor light emitting device into with a bluish green color (480nm thru/or 500nm) luminescence wavelength while having the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm Seemingly, if the light from this fluorescent substance takes human being's visibility into consideration, since a color tone hardly changes by the direct light from the above-mentioned semi-conductor light emitting device, this semi-conductor luminescence equipment has a good color tone, and light can be emitted in the light of a monochrome bluish green color. Moreover, since the luminescence wavelength of the above-mentioned semi-conductor light emitting device is 390nm thru/or 420nm, breakage on the components which constitute the above-mentioned semi-conductor luminescence equipment, and the adverse effect to the body can be prevented effectively.

[0200] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance It Eu(s) and D(ies). Sr4aluminum14O25:Eu and Sr4aluminum14O25: — L10(PO4) 6Cl2:Eu (however, any one or two or more elements with which L is chosen from Ba, calcium, and Mg), since it consists of any one or 2 or more Sr2Si3O8 and 2SrCl2:Eu, and among the groups of a fluorescent substance come out of and expressed The optimal fluorescent substance can be chosen according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of bluish green color monochrome luminescence of a good color tone can be obtained, and semi-conductor luminescence equipment with the high utilization effectiveness of the light of a semi-conductor light emitting device can be obtained combining two or more fluorescent substances.

[0201] The semi-conductor luminescence equipment of this invention the above-mentioned semi-conductor light emitting device Since it has the fluorescent substance which changes the outgoing radiation light from this semi-conductor light emitting device into the orange luminescence wavelength of 570nm thru/or 600nm while having the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm If human being's visibility is taken into consideration, since the light from this fluorescent substance hardly changes a color tone by the direct light from the above-mentioned semi-conductor light emitting device, it can emit light seemingly in a monochrome orange light with a color tone good [this semi-conductor luminescence equipment]. Moreover, since the luminescence wavelength of the above-mentioned semi-conductor light emitting device is 390nm thru/or 420nm, breakage on the components which constitute the above-mentioned semi-conductor luminescence equipment, and the adverse effect to the body can be prevented effectively.

[0202] since the above-mentioned fluorescent substance consists of any one or 2 or more ZnS:Mn, ZnS:Cu, Mn and Co, and among the groups of a fluorescent substance come out of and expressed, it can choose the optimal fluorescent substance according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, and the semi-conductor luminescence equipment of 1 operation gestalt can obtain the semi-conductor luminescence equipment of orange monochrome luminescence.

[0203] Since the closure resin which closes at least the part and the above-mentioned semi-conductor light emitting device of the base which carries a semi-conductor light emitting device contains the fluorescent substance, the semi-conductor luminescence equipment of 1 operation gestalt can carry out wavelength conversion of the outgoing radiation light from a semi-conductor light emitting device certainly, and is made into efficient semi-conductor luminescence equipment. Moreover, if closure resin is formed, since a fluorescent substance can be arranged, it is not necessary to arrange a fluorescent substance separately, and manufacture of semi-conductor luminescence equipment can be made easy.

[0204] Moreover, since the above-mentioned semi-conductor luminescence equipment obtains desired luminescence wavelength when luminescence wavelength combines the semi-conductor light emitting device which has a fixed wavelength field, and the fluorescent substance which has predetermined luminescence wavelength and it can obtain the semi-conductor luminescence luminescence equipment of desired luminescence wavelength only by changing a fluorescent substance by the same production process, it can reduce the manufacturing cost of semi-conductor luminescence equipment substantially.

[0205] While the semi-conductor luminescence equipment of 1 operation gestalt arranges a semi-conductor light emitting device at the bottom of the mounting section of the cup configuration formed at the head of a leadframe Since it connects with another leadframe electrically and at least the part and the above-mentioned semi-conductor light emitting device of the two above-mentioned leadframes are closed by the above-mentioned closure resin Since wavelength conversion of the outgoing radiation light from the semi-conductor light emitting device collected in the mounting section of the above-mentioned cup configuration is certainly carried out with the fluorescent substance which the above-mentioned closure resin contains, luminous efficiency can obtain semi-conductor luminescence equipment with a good and sufficient color tone with sufficient directivity.

[0206] Since the semi-conductor luminescence equipment of 1 operation gestalt carries out direct continuation of the above-mentioned semi-conductor light emitting device to metal wiring of the insulator connected at the head of the leadframe of a couple and is closing at least the part, the above-mentioned insulator, and the above-mentioned semi-conductor light emitting device of a leadframe of a up Norikazu pair by the above-mentioned closure resin, it can manufacture semi-conductor luminescence equipment easily rather than it connects a semi-conductor light emitting device to metal wiring by wire bonding etc.
[0207] While the semi-conductor luminescence equipment of 1 operation gestalt arranges a semi-conductor light emitting device at the bottom of the mounting section of the cup configuration formed at the head of a leadframe Since it connects with another leadframe electrically, the mounting section of the above-mentioned cup configuration is filled up with a fluorescent substance and at least the part, the above-mentioned semi-conductor light emitting device, and the above-mentioned fluorescent substance of the above-mentioned leadframe are closed by closure resin While being able to carry out the wavelength conversion of the light from a semi-conductor light emitting device certainly and being able to make it efficient semi-conductor luminescence equipment, it can do few rather than it makes closure resin contain a fluorescent substance so that in the above-mentioned operation gestalt for the amount of the above-mentioned fluorescent substance used.
[0208] While the semi-conductor luminescence equipment of 1 operation gestalt arranges a semi-conductor light emitting device at the bottom of the mounting section of the cup configuration formed at the head of a leadframe Connect with another leadframe electrically, fill up the mounting section of the above-mentioned cup configuration with a coating member, and a fluorescent substance is further arranged on the above-mentioned coating member. Since at least the part, the above-mentioned semi-conductor light emitting device, the above-mentioned coating member, and the above-mentioned fluorescent substance of the two above-mentioned leadframes are closed by closure resin, the amount of the fluorescent substance used can be made fewer than the case where all the above-mentioned mounting circles are filled up with a fluorescent substance. Moreover, since distance between the light-emitting part of the above-mentioned semi-conductor light emitting device and a fluorescent substance is made to abbreviation homogeneity by the above-mentioned coating member, there is no irregular color and light of semi-conductor luminescence equipment is made to homogeneity. Furthermore, since the above-mentioned coating member estranges the above-mentioned semi-conductor light emitting device and a fluorescent substance, electric and thermal degradation of the fluorescent substance by the semi-conductor light emitting device can be prevented.

[0209] The semi-conductor luminescence equipment of 1 operation gestalt connects with metal wiring of a substrate, and carries a semi-conductor light emitting device, and since the above-mentioned semi-conductor light emitting device is closed with the closure resin containing a fluorescent substance, it Since the semi-conductor luminescence equipment of the luminescence wavelength of the request only by only changing the class of fluorescent substance contained in the above-mentioned closure resin without changing the class of the above-mentioned semi-conductor light emitting device is obtained, the semi-conductor luminescence equipment of two or more requests can manufacture more easily than before, consequently semi-conductor luminescence equipment can manufacture to low cost.
[0210] Since the amount of the above-mentioned fluorescent substance used can be made little since it is arranged in the crevice of a substrate while connecting to metal wiring of a substrate electrically [the semi-conductor luminescence equipment of 1 operation gestalt / a semi-conductor light emitting device], and the above-mentioned crevice is filled up with the fluorescent substance, a manufacturing cost can be made cheap and wavelength conversion of the light from a semi-conductor light emitting device is moreover certainly carried out with the above-mentioned fluorescent substance, semi-conductor luminescence equipment with sufficient luminous efficiency is obtained.
[0211] Since the above-mentioned crevice is formed with the frame arranged at the above-mentioned substrate, the semi-conductor luminescence equipment of 1 operation gestalt can reduce the time and effort of processing which cuts a substrate, for example and forms a crevice. Moreover, if the field by the side of the semi-conductor light emitting device of the above-mentioned frame is processed into the configuration which condenses the outgoing radiation light from the above-mentioned semi-conductor light emitting device, the conversion efficiency of the wavelength of the above-mentioned outgoing radiation light can be improved further.
[0212] Since the semi-conductor luminescence equipment of 1 operation gestalt is arranged in the crevice of a substrate while the semi-conductor light emitting device is electrically connected to metal wiring of a substrate, and it arranges the fluorescent substance on the above-mentioned closure resin while it has filled up this crevice with closure resin, it can reduce the amount of the above-mentioned fluorescent substance used rather than it is filled up with a fluorescent substance inside the crevice of a substrate like the above-mentioned operation gestalt. Moreover, since the above-mentioned closure resin makes abbreviation homogeneity distance between the light-emitting part of a semi-conductor light emitting device, and a fluorescent substance, it can obtain luminescence of the homogeneity which does not almost have an irregular color. Moreover, since the above-mentioned closure resin makes a high order semi-conductor light emitting device and a fluorescent substance estrange, it reduces the electric and thermal effect of a semi-conductor light emitting device to the above-mentioned fluorescent substance, and the engine performance of semi-conductor luminescence equipment is made as for it to stability.
[0213] As for the semi-conductor luminescence equipment of 1 operation gestalt, a semi-conductor light emitting device is connected to metal wiring of a substrate. Since it has closure resin which the reflected light from the above-mentioned reflector penetrates and the fluorescent substance is contained in the above-mentioned closure

resin while having the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device and closing the above-mentioned semi-conductor light emitting device Since the semi-conductor luminescence equipment of desired luminescence wavelength is obtained only by changing the class of the above-mentioned fluorescent substance without changing the class of the above-mentioned semi-conductor light emitting device, semi-conductor luminescence equipment can be manufactured easily and cheaply conventionally. Moreover, since wavelength conversion of the outgoing radiation light from the above-mentioned semi-conductor light emitting device and the reflected light reflected by the above-mentioned reflector is carried out certainly, semi-conductor luminescence equipment with the sufficient utilization effectiveness of light can be obtained.

[0214] While connecting with metal wiring and the electric target of a substrate and equipping a semi-conductor light emitting device with the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of 1 operation gestalt The exterior of semi-conductor luminescence equipment is equipped with the screen which interrupts the light which carries out direct outgoing radiation from the above-mentioned semi-conductor light emitting device. Since it has closure resin which the reflected light from the above-mentioned reflector penetrates and the layer of a fluorescent substance is prepared in the field which light reflects in the above-mentioned reflector while closing the above-mentioned semi-conductor light emitting device Since wavelength conversion is carried out while the light from a semi-conductor light emitting device is surely reflected by the above-mentioned reflector, and outgoing radiation is carried out to the exterior of semi-conductor luminescence equipment, since what is necessary is to prepare a fluorescent substance only in a reflector, the amount of the fluorescent substance used can be reduced, and cheaply efficient semi-conductor luminescence equipment is obtained. Furthermore, the layer of the above-mentioned fluorescent substance is formed in the reflector of the reflector which makes a predetermined distance from a semi-conductor light emitting device, and since the distance of abbreviation homogeneity is kept and it is arranged from a semi-conductor light emitting device, it is made to the semi-conductor luminescence equipment of homogeneity luminescence without an irregular color. Furthermore, since a semi-conductor light emitting device and a fluorescent substance are estranged, it is made to electric and the semi-conductor luminescence equipment which has the engine performance which thermal effect was eased and was stabilized of the semi-conductor light emitting device to this fluorescent substance.

[0215] While connecting with metal wiring and the electric target of a substrate and equipping a semi-conductor light emitting device with the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of 1 operation gestalt A part for the light-emitting part of the above-mentioned semi-conductor light emitting device is arranged in the crevice of the above-mentioned substrate. Since it has closure resin which the reflected light from the above-mentioned reflector penetrates and the layer of a fluorescent substance is prepared in the field which light reflects in the above-mentioned reflector while closing the above-mentioned semi-conductor light emitting device Since outgoing radiation of the light from the above-mentioned semi-conductor light emitting device is carried out to the exterior of semi-conductor luminescence equipment after wavelength conversion is carried out, while surely being reflected in the exterior of semi-conductor luminescence equipment by the above-mentioned reflector, without carrying out direct outgoing radiation, a color tone is made as for it to the semi-conductor luminescence equipment which has a good outgoing radiation light.

[0216] The semi-conductor light emitting device is connected to metal wiring and the electric target of a substrate for the semi-conductor luminescence equipment of 1 operation gestalt. It has the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device. Since it has closure resin which the reflected light from the above-mentioned reflector penetrates and the layer of a fluorescent substance is prepared in the field as for which the light of the above-mentioned closure resin carries out outgoing radiation while closing the above-mentioned semi-conductor light emitting device, wavelength conversion is surely carried out and light by which outgoing radiation is carried out from semi-conductor luminescence equipment is made to the semi-conductor luminescence equipment with sufficient utilization effectiveness of light. Moreover, it is made to electric and the semi-conductor luminescence equipment which has the engine performance which could ease thermal effect and was stabilized of the semi-conductor light emitting device to the above-mentioned fluorescent substance while it is made to the semi-conductor luminescence equipment of homogeneity luminescence without an irregular color, since the layer of the above-mentioned fluorescent substance keeps the distance of abbreviation homogeneity and is arranged from a semi-conductor light emitting device.

[0217] The semi-conductor luminescence equipment of this invention carries on a base the semi-conductor light emitting device which has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm. The 1st fluorescent substance which has a red outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 600nm thru/or 670nm, The 2nd fluorescent substance which has a green outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 500nm thru/or 540nm, Equip the wavelength field whose luminescence wavelength is 410nm thru/or 480nm with the 3rd fluorescent substance which has a blue outgoing radiation light which has the main luminescence peak, and since the sum of the color of the outgoing radiation light from the 1st, 2nd, and 3rd fluorescent substance of the above is a white system the light in which the above-mentioned semi-conductor light emitting device has upwards the luminescence wavelength of the short wavelength field where human being's visibility is very low, and the fluorescent substance of each above carries out outgoing radiation the luminescent

color of the white system of a good color tone can be obtained without a color tone changing with outgoing radiation light with an outgoing radiation light direct from the above-mentioned semi-conductor light emitting device from the fluorescent substance of each above, since it is the light of red and green and blue monochrome respectively. Moreover, since color mixture of the light by which direct outgoing radiation is carried out to the semi-conductor luminescence equipment exterior is not carried out to the light from a fluorescent substance in human being's visible region from the above-mentioned semi-conductor light emitting device, even if the luminescence engine performance of a semi-conductor light emitting device falls according to secular change, it is only that the brightness of semi-conductor luminescence equipment falls, and can prevent that a color tone changes. Moreover, since the luminescence wavelength of the above-mentioned semi-conductor light emitting device is 390nm thru/or 420nm, breakage on the components which constitute the above-mentioned semi-conductor luminescence equipment, and the adverse effect to the body can be prevented effectively.

[0218] The semi-conductor luminescence equipment of 1 operation gestalt the 1st fluorescent substance of the above M2O2 S:Eu (however, any one or two or more elements with which M is chosen from La, Gd, and Y), 0.5MgF2 and 3.5 MgO-GeO2:Mn, Y2O3:Eu, It consists of any one or 2 or more Y(P, V) O4:Eu, YVO4:Eu, and among the groups of a fluorescent substance come out of and expressed. the 2nd fluorescent substance of the above RMg2aluminum16O27: — Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) — RMgAl10O17: — Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) — It Eu(s) and D(ies). ZnS:Cu, SrAl2O4:Eu, and SrAl2O4: — ZnO:Zn, Zn2germanium2O4:Mn, Zn2SiO4:Mn, and Q3MgSi2O8:Eu - - Mn It consists of any one or 2 or more however, (any one or two or more elements) with which Q is chosen from Sr, Ba, and calcium, and among the groups of a fluorescent substance come out of and expressed. the 3rd fluorescent substance of the above A10(PO4) 6Cl2:Eu (however, any one or two or more elements with which A is chosen from Sr, calcium, Ba, Mg, and Ce), XMg2aluminum16O27:Eu (however, any one as which X is chosen from Sr and Ba or both elements), XMgAl10O17:Eu (however, any one as which X is chosen from Sr and Ba or both elements), ZnS:Ag, Sr10(PO4) 6Cl2:Eu, calcium10(PO4) 6F2:Sb, Z3MgSi2O8:Eu (however, any one or two or more elements with which Z is chosen from Sr, Ba, and calcium), SrMgSi2O8:Eu, Sr2P2O7:Eu, and CaAl2O4:, since it consists of any one or 2 or more Eu, Nd, and among the groups of a fluorescent substance come out of and expressed Even if it uses the semi-conductor light emitting device which has which luminescence wavelength of the inside whose luminescence wavelength is 390nm thru/or 420nm By choosing a suitable fluorescent substance from two or more above-mentioned fluorescent substances corresponding to the luminescence wavelength of this semi-conductor light emitting device Since red, monochromatic green, and a monochromatic blue luminescence light can obtain respectively, the light of the white system of a good color tone can be obtained with the red of these monochrome, and the color mixture of a green and blue light. Moreover, since the light of the wavelength of all abbreviation for the luminescence wavelength of a semi-conductor light emitting device is respectively convertible for red and green and blue wavelength by forming the above-mentioned fluorescent substance combining two or more fluorescent substances, the utilization effectiveness of the outgoing radiation light of a semi-conductor light emitting device can be improved, and it is made to the semi-conductor luminescence equipment which has the luminescent color of an efficient white system.

[0219] The semi-conductor luminescence equipment of 1 operation gestalt the 1st, 2nd, and 3rd fluorescent substance of the above Since the 2nd fluorescent substance of the above is 30 or less % of the weight, the 3rd fluorescent substance of the above 20% of the weight or more 20 or less % of the weight 7% of the weight or more 70 or less % of the weight 50% of the weight or more, noting that a total amount is 100 % of the weight [the 1st fluorescent substance of the above] Since human being's visibility strengthens the luminous intensity of a low outgoing radiation light of the 1st and 3rd fluorescent substances, i.e., blue, and red compared with a green light in which the 2nd fluorescent substance of the above carries out outgoing radiation, in consideration of human being's visibility, it is made to the semi-conductor luminescence equipment which has the luminescent color of the white system of a good color tone.

[0220] The above-mentioned closure resin contains the 1st, 2nd, and 3rd fluorescent substance of the above, and the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance of the above to the weight of the above-mentioned closure resin is made as for the semi-conductor luminescence equipment of 1 operation gestalt to the or more 0.5 luminescence.[semi-conductor] equipment which has the luminescent color of the white system near the natural light since it is one or less.

[0221] The light source for which the luminescence display of 1 operation gestalt used the above-mentioned semi-conductor luminescence equipment, It has the light guide plate to which the light from the above-mentioned light source is led, and the light filter of green [which are made to penetrate the light from the above-mentioned light guide plate, and carry out a spectrum / the red and green], and blue. The outgoing radiation light of the above-mentioned semi-conductor luminescence equipment Since it has the wavelength distribution which suited the spectral characteristic of the above-mentioned light filter, the outgoing radiation light of the above-mentioned semi-conductor luminescence equipment is the monochrome of red, green, and blue, and since it can carry out a spectrum to the light of comparatively large reinforcement, its utilization effectiveness of light is good and is made as for it to the luminescence display of high brightness.

[0222] The luminescence display of 1 operation gestalt so that wavelength distribution of the outgoing radiation light of semi-conductor luminescence equipment may suit the spectral characteristic of the above-mentioned light filter The luminescence wavelength of the above-mentioned semi-conductor light emitting device, and the luminescence wavelength of the 1st fluorescent substance of the above, The luminescence wavelength of the 2nd fluorescent

substance of the above, the luminescence wavelength of the 3rd fluorescent substance of the above, and the mixed ratio of the 1st, 2nd, and 3rd fluorescent substance of the above, Since at least one of the ratios of the AUW of the 1st, 2nd, and 3rd fluorescent substance of the above to the weight of the above-mentioned closure resin was adjusted With the above-mentioned light filter, since the spectrum of the light from the above-mentioned semiconductor luminescence equipment can be certainly carried out to the monochrome of red, green, and blue, and the light of comparatively high reinforcement, the above-mentioned luminescence display does not have a color omission etc., and the full color display of high brightness and high contrast can do it.

[0223] Since the above-mentioned luminescence display is a liquid crystal display, the luminescence display of 1 operation gestalt does not almost have a color omission, and the liquid crystal display of high brightness and high contrast is obtained.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, the above-mentioned Prior art has the following troubles.
[0009] The semi-conductor light emitting device which emits light the purple short wavelength light from the semi-conductor light emitting device which is used for long wavelength light semi-conductor luminescence equipment, and has the green luminescent color from red, and blue Since the ingredient and component configuration which are used according to the wavelength which emits light differ from each other, if the semiconductor device of mutually different wavelength tends to be mounted and it is going to obtain semi-conductor luminescence equipment Two or more mutually different mounting ingredients and mounting processes are needed, and while a production process becomes complicated, there is a problem of becoming the factor of a cost rise.
[0010] Furthermore, in order for color to acquire the good white light using two or more semi-conductor light emitting devices from which the above-mentioned luminescent color differs mutually, since it is necessary to adjust respectively the current to two or more above-mentioned semi-conductor light emitting devices, there is a problem that semi-conductor luminescence equipment becomes complicated. Moreover, when a luminescence display is formed using the above-mentioned semi-conductor luminescence equipment two or more, there is a trouble that adjustment of the color tone of the semi-conductor light emitting device of a large quantity is needed, and a production process becomes complicated.
[0011] Moreover, since the semi-conductor luminescence equipment currently indicated by the above-mentioned patent No. 2927279 and JP,10-163535,A carried out color mixture of the outgoing radiation light of a semi-conductor light emitting device, and this outgoing radiation light and the luminescence light of the fluorescent substance which has the relation of the complementary color and obtained the white luminescent color, it had the trouble that a color tone was not good, either, bad [the utilization effectiveness of light]. For example, when the semi-conductor luminescence equipment which acquires the white light with the color mixture of a blue outgoing radiation light of a semi-conductor light emitting device and the outgoing radiation light of the yellow of a fluorescent substance is used as a back light of a liquid crystal display, since there is little quantity of light of pure red and there are few amounts of the light which penetrates the red light filter with which the above-mentioned liquid crystal display is equipped, this white light has green pure and the trouble of giving an impression which carried out the color omission, when the above-mentioned liquid crystal display indicates by full color.
[0012] Moreover, since the semi-conductor luminescence equipment currently indicated by JP,10-12925,A impresses a pulse-like high current to a semi-conductor light emitting device, a semi-conductor light emitting device breaks, or it generates heat, and it deteriorates, and has the trouble that a life is short and it is unreliable. Moreover, since the above-mentioned semi-conductor light emitting device has the peak of luminescence wavelength also on blue wavelength while having the peak of luminescence wavelength on ultraviolet and near-ultraviolet wavelength, this blue glow carries out color mixture of it to the luminescence light of fluorescence, and it has the problem that a color tone is bad. Furthermore, since brightness does not deteriorate [the semi-conductor light emitting device which has the luminescent color from which plurality differs] uniformly and a blue wavelength component falls rapidly especially when semi-conductor luminescence equipment deteriorates, there is a trouble that the color tone of semi-conductor luminescence equipment will change. Furthermore, since the above-mentioned semi-conductor light emitting device carries out outgoing radiation of the light of the wavelength of the ultraviolet region by the side of short wavelength from near near-ultraviolet (390nm), the measure which prevents the effect on the body is required for it. Moreover, since the object for immobilization of the above-mentioned semi-conductor light emitting device and the resin for moulds also receive an adverse effect by the light of the wavelength of the above-mentioned ultraviolet region, they have the trouble that there is a possibility of causing lowering of the dependability by deterioration of the above-mentioned resin for immobilization and lowering of the luminescence brightness by the melanism of the above-mentioned resin for moulds.
[0013] While the semi-conductor luminescence equipment indicated by publication number No. 153644 [nine to] also needs to enforce the leakage control of the light of an ultraviolet region in order to prevent the effect on the body since it uses the luminescence wavelength of the ultraviolet region of 380nm, it has the trouble that the object for immobilization of a semi-conductor light emitting device and the resin for moulds cause lowering of dependability, and lowering of luminescence brightness in response to an adverse effect. Furthermore, this semi-conductor luminescence equipment has the trouble that the production process of semi-conductor luminescence equipment is complicated, and the yield and dependability fall on a substrate since red, blue, and the fluorescent substance layer that emits light in the green three primary colors are formed with a semi-conductor layer.
[0014] In spite of being made in order to solve the above-mentioned technical problem, and being able to carry out

the outgoing radiation of the light of two or more luminescence wavelength, manufacture is easy and cheap, a color tone is good, there is little effect on the body, and this invention aims at offering the semi-conductor luminescence equipment which does not almost have degradation, and the luminescence display using it.

[Translation done.]

MEANS

[Means for Solving the Problem] In the semi-conductor luminescence equipment with which the semi-conductor luminescence equipment of this invention comes to carry a semi-conductor light emitting device on a base in order to attain the above-mentioned object, the above-mentioned semi-conductor light emitting device is characterized by to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 600nm thru/or 670nm with the fluorescent substance which carries out the outgoing radiation of the red light which has the main luminescence peak.
[0016] According to this invention, in the above-mentioned semi-conductor luminescence equipment, the above-mentioned semi-conductor light emitting device has upwards the outgoing radiation light of the short wavelength field where human being's visibility is very low, and the above-mentioned fluorescent substance Since luminescence wavelength has the main luminescence peak to a red wavelength field and carries out outgoing radiation of the light of monochromatic red Even if the light and a direct outgoing radiation light from the above-mentioned semi-conductor light emitting device the above-mentioned fluorescent substance carries out [light] outgoing radiation are mixed, if human being's visibility is taken into consideration, the color tone of the outgoing radiation light of the above-mentioned fluorescent substance will hardly change seemingly. That is, outgoing radiation of the light from the above-mentioned fluorescent substance is carried out from semi-conductor luminescence equipment, without being influenced of the direct light from the above-mentioned semi-conductor light emitting device. Therefore, the semi-conductor luminescence equipment of monochrome red luminescence with a good color tone is obtained.
[0017] Moreover, in the above-mentioned semi-conductor luminescence equipment, since the above-mentioned semi-conductor light emitting device has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, it cannot damage the component part of semi-conductor luminescence equipments, such as closure resin, easily, for example, and does not almost have an operation harmful to the body. If the luminescence wavelength of a semi-conductor light emitting device is shorter than 390nm, the above-mentioned closure resin is damaged, for example, and inconvenience, such as opacification and melanism, may be produced. On the other hand, if the luminescence wavelength of the above-mentioned semi-conductor light emitting device is longer than 420nm, since the outgoing radiation light from this semi-conductor light emitting device comes to have the luminescence wavelength of a visible region, it will carry out color mixture to the outgoing radiation light from the above-mentioned fluorescent substance, and the color tone of the luminescent color of semi-conductor luminescence equipment will change. Therefore, by setting luminescence wavelength of the above-mentioned semi-conductor light emitting device to 390nm thru/or 420nm, degradation of the component part of semi-conductor luminescence equipment can be lessened, and there is almost no adverse effect in the body, and, moreover, semi-conductor luminescence equipment with a good color tone is obtained.
[0018] in the semi-conductor luminescence equipment of 1 operation gestalt, the above-mentioned fluorescent substance consists of any one or 2 or more M2O2 S:Eu (however, any one or two or more elements with which M is chosen from La, Gd, and Y), 0.5MgF2 and 3.5 MgO-GeO2:Mn, Y2O3:Eu, Y(P, V) O4:Eu, YVO4:Eu, and among the groups of a fluorescent substance come out of and expressed.
[0019] Since according to the above-mentioned operation gestalt the above-mentioned fluorescent substance can be chosen according to the wavelength of the outgoing radiation light of the above-mentioned semi-conductor light emitting device even if it uses the semi-conductor light emitting device which has which outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, the semi-conductor luminescence equipment of monochrome red luminescence with which luminescence wavelength has a good luminescence peak to a red wavelength field is obtained. Moreover, since the wavelength of all abbreviation for the wavelength field of the outgoing radiation light of a semi-conductor light emitting device is convertible for red wavelength by combining two or more fluorescent substances, the semi-conductor luminescence equipment of efficient monochrome red luminescence is obtained.
[0020] In the semi-conductor luminescence equipment with which the semi-conductor luminescence equipment of this invention comes to carry a semi-conductor light emitting device on a base, the above-mentioned semi-conductor light emitting device is characterized by to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 500nm thru/or 540nm with the fluorescent substance which carries out outgoing radiation of the green light which has the main luminescence peak.

[0021] According to this invention, in the above-mentioned semi-conductor luminescence equipment, the above-mentioned semi-conductor light emitting device has upwards the outgoing radiation light of the short wavelength field where human being's visibility is very low, and the above-mentioned fluorescent substance Since luminescence wavelength has the main luminescence peak to a green wavelength field and carries out outgoing radiation of the monochromatic green light Even if the light and a direct outgoing radiation light from the above-mentioned semi-conductor light emitting device the above-mentioned fluorescent substance carries out [light] outgoing radiation are mixed, if human being's visibility is taken into consideration, the color tone of the outgoing radiation light of the above-mentioned fluorescent substance will hardly change seemingly. That is, outgoing radiation of the light from the above-mentioned fluorescent substance is carried out from semi-conductor luminescence equipment, without being influenced of the direct light from the above-mentioned semi-conductor light emitting device. Therefore, the semi-conductor luminescence equipment of monochrome green luminescence with a good color tone is obtained.
[0022] Moreover, in the above-mentioned semi-conductor luminescence equipment, since the above-mentioned semi-conductor light emitting device has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, it cannot damage the component part of semi-conductor luminescence equipments, such as closure resin, easily, for example, and does not almost have an operation harmful to the body. If the luminescence wavelength of a semi-conductor light emitting device is shorter than 390nm, the above-mentioned closure resin is damaged, for example, and inconvenience, such as opacification and melanism, may be produced. On the other hand, if the luminescence wavelength of the above-mentioned semi-conductor light emitting device is longer than 420nm, since the outgoing radiation light from this semi-conductor light emitting device comes to have the luminescence wavelength of a visible region, it will carry out color mixture to the outgoing radiation light from the above-mentioned fluorescent substance, and the color tone of the luminescent color of semi-conductor luminescence equipment will change. Therefore, by setting luminescence wavelength of the above-mentioned semi-conductor light emitting device to 390nm thru/or 420nm, degradation of the component part of semi-conductor luminescence equipment can be lessened, and there is almost no adverse effect in the body, and, moreover, semi-conductor luminescence equipment with a good color tone is obtained.
[0023] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance RMg2aluminum16O27: -- Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) -- RMgAl10O17: -- Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) -- It Eu(s) and D(ies). ZnS:Cu, SrAl2O4:Eu, and SrAl2O4: -- ZnO:Zn, Zn2germanium2O4:Mn, Zn2SiO4:Mn, and Q3MgSi2O8: -- it consists of any one or 2 or more Eu, Mn (however, any one or two or more elements with which Q is chosen from Sr, Ba, and calcium), and among the groups of a fluorescent substance come out of and expressed.
[0024] According to the above-mentioned operation gestalt, since the optimal fluorescent substance can be chosen according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of monochrome green luminescence which has a good luminescence peak to the wavelength field where luminescence wavelength is green is obtained. Moreover, since the wavelength of all abbreviation for the wavelength field of the outgoing radiation light of a semi-conductor light emitting device is convertible for green wavelength by combining two or more fluorescent substances, the semi-conductor luminescence equipment of efficient monochrome green luminescence is obtained.
[0025] In the semi-conductor luminescence equipment with which the semi-conductor luminescence equipment of this invention comes to carry a semi-conductor light emitting device on a base, the above-mentioned semi-conductor light emitting device is characterized by to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 410nm thru/or 480nm with the fluorescent substance which carries out outgoing radiation of the blue light which has the main luminescence peak.
[0026] According to this invention, in the above-mentioned semi-conductor luminescence equipment, the above-mentioned semi-conductor light emitting device has upwards the outgoing radiation light of the short wavelength field where human being's visibility is very low, and the above-mentioned fluorescent substance Since luminescence wavelength has the main luminescence peak to a blue wavelength field and carries out outgoing radiation of the monochromatic blue light Even if the light and a direct outgoing radiation light from the above-mentioned semi-conductor light emitting device the above-mentioned fluorescent substance carries out [light] outgoing radiation are mixed, if human being's visibility is taken into consideration, the color tone of the outgoing radiation light of the above-mentioned fluorescent substance will hardly change seemingly. That is, outgoing radiation of the light from the above-mentioned fluorescent substance is carried out from semi-conductor luminescence equipment, without being influenced of the direct light from the above-mentioned semi-conductor light emitting device. Therefore, the semi-conductor luminescence equipment of monochrome blue luminescence with a good color tone is obtained.
[0027] Moreover, in the above-mentioned semi-conductor luminescence equipment, since the above-mentioned semi-conductor light emitting device has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, it cannot damage the component part of semi-conductor luminescence equipments, such as closure resin, easily, for example, and does not almost have an operation harmful to the body. If the luminescence wavelength of a semi-conductor light emitting device is shorter than 390nm, the above-mentioned closure resin is damaged, for example, and inconvenience, such as opacification and melanism, may be produced. On the other hand, if the luminescence wavelength of the above-mentioned semi-conductor light emitting device is longer than 420nm, since the outgoing radiation light from this semi-conductor light emitting device comes to have the luminescence

wavelength of a visible region, it will carry out color mixture to the outgoing radiation light from the above-mentioned fluorescent substance, and the color tone of the luminescent color of semi-conductor luminescence equipment will change. Therefore, by setting luminescence wavelength of the above-mentioned semi-conductor light emitting device to 390nm thru/or 420nm, degradation of the component part of semi-conductor luminescence equipment can be lessened, and there is almost no adverse effect in the body, and, moreover, semi-conductor luminescence equipment with a good color tone is obtained.

[0028] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance A10(PO4) 6Cl2:Eu (however, any one or two or more elements with which A is chosen from Sr, calcium, Ba, Mg, and Ce), XMg2aluminum16O27:Eu (however, any one as which X is chosen from Sr and Ba or both elements), XMgAl10O17:Eu (however, any one as which X is chosen from Sr and Ba or both elements), ZnS:Ag, Sr10 (PO4) 6Cl2:Eu, calcium10(PO4) 6F2:Sb, Z3MgSi2O8:Eu (however, any one or two or more elements with which Z is chosen from Sr, Ba, and calcium), SrMgSi2O8:Eu, Sr2P2O7:Eu, and CaAl2O4: — it consists of any one or 2 or more Eu, Nd, and among the groups of a fluorescent substance come out of and expressed.

[0029] According to the above-mentioned operation gestalt, since the optimal fluorescent substance can be chosen according to the luminescence wavelength of a semi-conductor light emitting device, the semi-conductor luminescence equipment of monochrome blue luminescence which has a good luminescence peak to the wavelength field where luminescence wavelength is blue is obtained. Moreover, since the wavelength of all abbreviation for the wavelength field of the outgoing radiation light of the above-mentioned semi-conductor light emitting device is convertible for blue wavelength by combining two or more fluorescent substances, the semi-conductor luminescence equipment of efficient monochrome blue luminescence is obtained.

[0030] In the semi-conductor luminescence equipment with which the semi-conductor luminescence equipment of this invention comes to carry a semi-conductor light emitting device on a base, the above-mentioned semi-conductor light emitting device is characterized by to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 480nm thru/or 500nm with the fluorescent substance which carries out outgoing radiation of the light of a bluish-green color which has the main luminescence peak.

[0031] According to this invention, in the above-mentioned semi-conductor luminescence equipment, the above-mentioned semi-conductor light emitting device has upwards the outgoing radiation light of the short wavelength field where human being's visibility is very low, and the above-mentioned fluorescent substance Since luminescence wavelength has the main luminescence peak to the wavelength field of a bluish green color and carries out outgoing radiation of the light of a monochromatic bluish green color Even if the light and a direct outgoing radiation light from the above-mentioned semi-conductor light emitting device the above-mentioned fluorescent substance carries out [light] outgoing radiation are mixed, if human being's visibility is taken into consideration, the color tone of the outgoing radiation light of the above-mentioned fluorescent substance will hardly change seemingly. That is, outgoing radiation of the light from the above-mentioned fluorescent substance is carried out from semi-conductor luminescence equipment, without being influenced of the direct light from the above-mentioned semi-conductor light emitting device. Therefore, the semi-conductor luminescence equipment of monochrome bluish green color luminescence with a good color tone is obtained.

[0032] Moreover, in the above-mentioned semi-conductor luminescence equipment, since the above-mentioned semi-conductor light emitting device has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, it cannot damage the component part of semi-conductor luminescence equipments, such as closure resin, easily, for example, and does not almost have an operation harmful to the body. If the luminescence wavelength of a semi-conductor light emitting device is shorter than 390nm, the above-mentioned closure resin is damaged, for example, and inconvenience, such as opacification and melanism, may be produced. On the other hand, if the luminescence wavelength of the above-mentioned semi-conductor light emitting device is longer than 420nm, since the outgoing radiation light from this semi-conductor light emitting device comes to have the luminescence wavelength of a visible region, it will carry out color mixture to the outgoing radiation light from the above-mentioned fluorescent substance, and the color tone of the luminescent color of semi-conductor luminescence equipment will change. Therefore, by setting luminescence wavelength of the above-mentioned semi-conductor light emitting device to 390nm thru/or 420nm, degradation of the component part of semi-conductor luminescence equipment can be lessened, and there is almost no adverse effect in the body, and, moreover, semi-conductor luminescence equipment with a good color tone is obtained.

[0033] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned fluorescent substance It Eu(s) and D(ies). Sr4aluminum14O25:Eu and Sr4aluminum14O25: — it consists of any one or 2 or more L10(PO4) 6Cl2:Eu (however, any one or two or more elements with which L is chosen from Ba, calcium, and Mg), Sr2Si3O8 and 2SrCl2:Eu, and among the groups of a fluorescent substance come out of and expressed.

[0034] According to the above-mentioned operation gestalt, since the optimal fluorescent substance can be chosen according to the luminescence wavelength of the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of monochrome bluish green color luminescence with which luminescence wavelength has a good luminescence peak to the wavelength field of a bluish green color is obtained. Moreover, since the wavelength of all abbreviation for the wavelength field of light in which the above-mentioned semi-conductor light emitting device carries out outgoing radiation by combining two or more fluorescent substances is convertible for the wavelength of a bluish green color, the semi-conductor luminescence equipment of efficient

monochrome bluish green color luminescence is obtained.
[0035] In the semi-conductor luminescence equipment with which the semi-conductor luminescence equipment of this invention comes to carry a semi-conductor light emitting device on a base, the above-mentioned semi-conductor light emitting device is characterized by to have the outgoing-radiation light whose luminescence wavelength is 390nm thru/or 420nm, to be excited by the outgoing-radiation light from the above-mentioned semi-conductor light emitting device, and to equip the wavelength field whose luminescence wavelength is 570nm thru/or 600nm with the fluorescent substance which carries out outgoing radiation of the orange light which has the main luminescence peak.
[0036] According to this invention, in the above-mentioned semi-conductor luminescence equipment, the above-mentioned semi-conductor light emitting device has upwards the outgoing radiation light of the short wavelength field where human being's visibility is very low, and the above-mentioned fluorescent substance Since luminescence wavelength has the main luminescence peak to an orange wavelength field and carries out outgoing radiation of the monochromatic orange light Even if the light and a direct outgoing radiation light from the above-mentioned semi-conductor light emitting device the above-mentioned fluorescent substance carries out [light] outgoing radiation are mixed, if human being's visibility is taken into consideration, the color tone of the outgoing radiation light of the above-mentioned fluorescent substance will hardly change seemingly. That is, outgoing radiation of the light from the above-mentioned fluorescent substance is carried out from semi-conductor luminescence equipment, without being influenced of the direct light from the above-mentioned semi-conductor light emitting device. Therefore, the semi-conductor luminescence equipment of monochrome orange light emitting with a good color tone is obtained.
[0037] Moreover, in the above-mentioned semi-conductor luminescence equipment, since the above-mentioned semi-conductor light emitting device has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, it cannot damage the component part of semi-conductor luminescence equipments, such as closure resin, easily, for example, and does not almost have an operation harmful to the body. If the luminescence wavelength of a semi-conductor light emitting device is shorter than 390nm, the above-mentioned closure resin is damaged, for example, and inconvenience, such as opacification and melanism, may be produced. On the other hand, if the luminescence wavelength of the above-mentioned semi-conductor light emitting device is longer than 420nm, since the outgoing radiation light from this semi-conductor light emitting device comes to have the luminescence wavelength of a visible region, it will carry out color mixture to the outgoing radiation light from the above-mentioned fluorescent substance, and the color tone of the luminescent color of semi-conductor luminescence equipment will change. Therefore, by setting luminescence wavelength of the above-mentioned semi-conductor light emitting device to 390nm thru/or 420nm, degradation of the component part of semi-conductor luminescence equipment can be lessened, and there is almost no adverse effect in the body, and, moreover, semi-conductor luminescence equipment with a good color tone is obtained.
[0038] in the semi-conductor luminescence equipment of 1 operation gestalt, the above-mentioned fluorescent substance consists of any one or 2 or more ZnS:Mn, ZnS:Cu, Mn and Co, and among the groups of a fluorescent substance come out of and expressed.
[0039] According to the above-mentioned operation gestalt, since the optimal fluorescent substance can be chosen according to the wavelength field of a semi-conductor light emitting device, luminescence wavelength can obtain the semi-conductor luminescence equipment of the monochrome orange light emitting which has the main luminescence peak to an orange luminescence wavelength field.
[0040] The semi-conductor luminescence equipment of 1 operation gestalt is equipped with the closure resin which closes at least the part and the above-mentioned semi-conductor light emitting device of the above-mentioned base, and the above-mentioned closure resin contains the above-mentioned fluorescent substance.
[0041] Since the closure resin which closes the above-mentioned semi-conductor light emitting device contains the fluorescent substance according to the above-mentioned operation gestalt, since wavelength conversion is surely carried out, the outgoing radiation light from a semi-conductor light emitting device has the good utilization effectiveness of the light of a semi-conductor light emitting device. Moreover, since a fluorescent substance can be arranged while forming closure resin and the process which arranges a fluorescent substance separately is unnecessary, manufacture of semi-conductor luminescence equipment becomes easy.
[0042] Moreover, the semiconductor device which has desired luminescence wavelength is obtained, without changing the structure of a semi-conductor light emitting device and semi-conductor luminescence equipment, when this semi-conductor luminescence equipment combines the semi-conductor light emitting device which has the wavelength field where luminescence wavelength is fixed, and a predetermined fluorescent substance. That is, by the same production process, since the semi-conductor luminescence luminescence equipment which has desired luminescence wavelength is obtained, the manufacturing cost of semi-conductor luminescence equipment is substantially reducible only only changing a fluorescent substance.
[0043] The semi-conductor luminescence equipment of 1 operation gestalt is a leadframe in which the above-mentioned base has the mounting section of a cup configuration, the above-mentioned semi-conductor light emitting device is arranged at the bottom of the mounting section of the cup configuration of the above-mentioned leadframe, and wire bonding connects with another leadframe electrically, and at least the part and the above-mentioned semi-conductor light emitting device of the two above-mentioned leadframes are closed by the above-mentioned closure resin.
[0044] Since wavelength conversion of the outgoing radiation light from the above-mentioned semi-conductor light emitting device collected by the mounting section of the above-mentioned cup configuration is certainly carried out

with the closure resin containing the above-mentioned fluorescent substance according to the above-mentioned operation gestalt, semi-conductor luminescence equipment with a color tone good luminous efficiency and sufficient is obtained with sufficient directivity.

[0045] The semi-conductor luminescence equipment of 1 operation gestalt is the insulator with which the above-mentioned base was connected at the head of the leadframe of a couple, the above-mentioned semi-conductor light emitting device is connected to metal wiring formed in the above-mentioned insulator, and at least the part, the above-mentioned insulator, and the above-mentioned semi-conductor light emitting device of a leadframe of a up Norikazu pair are closed by the above-mentioned closure resin.

[0046] According to the above-mentioned operation gestalt, since direct continuation of the above-mentioned semi-conductor light emitting device is carried out to metal wiring of the above-mentioned substrate for example, by a metal bump etc., the time and effort which connects a semi-conductor light emitting device and a leadframe with a metal wire etc. is saved. Moreover, wavelength conversion of the outgoing radiation light from a semi-conductor light emitting device is certainly carried out with the fluorescent substance contained in the above-mentioned closure resin. Therefore, manufacture effectiveness is good and, moreover, semi-conductor luminescence equipment with a color tone good luminous efficiency and sufficient is obtained.

[0047] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned base It is the leadframe which has the mounting section of a cup configuration. The above-mentioned semi-conductor light emitting device It is arranged at the bottom of the mounting section of the cup configuration of the above-mentioned leadframe. And while wire bonding connects with another leadframe electrically and the mounting section of the above-mentioned cup configuration is filled up with the above-mentioned fluorescent substance At least the part, the above-mentioned semi-conductor light emitting device, and the above-mentioned fluorescent substance of the two above-mentioned leadframes are closed by closure resin.

[0048] Since the mounting section of the cup configuration for which the light from the above-mentioned semi-conductor light emitting device gathers is filled up with a fluorescent substance according to the above-mentioned operation gestalt, wavelength conversion is carried out certainly and the utilization effectiveness of light from a semi-conductor light emitting device of light improves. Moreover, since the field which arranges a fluorescent substance is small as compared with the semi-conductor luminescence equipment which does not collect the light from a semi-conductor light emitting device, the amount of the above-mentioned fluorescent substance used can be lessened.

[0049] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned base It is the leadframe which has the mounting section of a cup configuration. The above-mentioned semi-conductor light emitting device It is arranged at the bottom of the mounting section of the cup configuration of the above-mentioned leadframe. And while wire bonding connects with another leadframe electrically, filling up the mounting section of the above-mentioned cup configuration with a coating member and arranging the above-mentioned fluorescent substance on the above-mentioned coating member At least the part, the above-mentioned semi-conductor light emitting device, the above-mentioned coating member, and the above-mentioned fluorescent substance of the two above-mentioned leadframes are closed by closure resin.

[0050] Since the above-mentioned fluorescent substance is arranged on the coating member filled up by the above-mentioned mounting section according to the above-mentioned operation gestalt, compared with the case where all the above-mentioned mounting circles are filled up with a fluorescent substance, the amount of the above-mentioned fluorescent substance used is reduced. Moreover, by the above-mentioned coating member, since the distance between the light-emitting part of the above-mentioned semi-conductor light emitting device and a fluorescent substance becomes abbreviation homogeneity, the semi-conductor luminescence equipment of homogeneity luminescence without an irregular color is obtained. Furthermore, since the above-mentioned semi-conductor light emitting device and a fluorescent substance are estranged by the above-mentioned coating member, there is almost no electric and thermal degradation of the fluorescent substance by the semi-conductor light emitting device.

[0051] The above-mentioned base is the substrate with which metal wiring was given, the above-mentioned semi-conductor light emitting device is electrically connected to metal wiring of the above-mentioned substrate, the semi-conductor luminescence equipment of 1 operation gestalt is equipped with the closure resin which closes the above-mentioned semi-conductor light emitting device, and the above-mentioned closure resin contains the above-mentioned fluorescent substance.

[0052] According to the above-mentioned operation gestalt, direct continuation of the above-mentioned semi-conductor light emitting device is done by the metal bump etc., without using metal wires, such as Au, and aluminum, Cu, for the semi-conductor light emitting device of the same configuration or a single class, connecting on metal wiring or using a metal wire etc. for the above-mentioned substrate. Therefore, the manufacture process of semi-conductor luminescence equipment is easy rather than it manufactures the semi-conductor luminescence equipment of a different configuration using the semi-conductor light emitting device of a different configuration [as / in the former] corresponding to the luminescent color. In this semi-conductor luminescence equipment, since the semi-conductor luminescence equipment which has desired luminescence wavelength only by arranging the predetermined fluorescent substance corresponding to desired wavelength is obtained, compared with the former, manufacture of semi-conductor luminescence equipment becomes simplicity and low cost.

[0053] The semi-conductor luminescence equipment of 1 operation gestalt is arranged in the crevice while the above-mentioned base is the substrate with which metal wiring was given and is connected electrically [the above-

mentioned semi-conductor light emitting device] to metal wiring of the above-mentioned substrate, and it fills up with the above-mentioned fluorescent substance in the above-mentioned crevice.

[0054] According to the above-mentioned operation gestalt, since the crevice of the above-mentioned substrate is filled up with the above-mentioned fluorescent substance, the amount of this fluorescent substance used becomes little, a manufacturing cost is cheap, luminous efficiency is good, and, moreover, semi-conductor luminescence equipment with a sufficient color tone is obtained by monochrome luminescence.

[0055] The semi-conductor luminescence equipment of 1 operation gestalt is formed with the frame with which the above-mentioned crevice has been arranged at the above-mentioned substrate.

[0056] Since according to the above-mentioned operation gestalt a frame is arranged to the above-mentioned substrate and the above-mentioned crevice is formed, the time and effort of processing which cuts a substrate, for example and forms a crevice is reduced. Moreover, in the configuration of the side face for example, by the side of the above-mentioned semi-conductor light emitting device, by processing the outgoing radiation light from the above-mentioned semi-conductor light emitting device into the condensing configuration, while the conversion efficiency of the wavelength of the above-mentioned outgoing radiation light improves further, the directivity of semi-conductor luminescence equipment improves the above-mentioned frame. Consequently, luminous efficiency is good and, moreover, semi-conductor luminescence equipment with a sufficient color tone is obtained by monochrome luminescence.

[0057] While in the semi-conductor luminescence equipment of 1 operation gestalt it is the given substrate, metal wiring is arranged in the crevice while the above-mentioned semi-conductor light emitting device is electrically connected to metal wiring of the above-mentioned substrate, and the above-mentioned base fills up the above-mentioned crevice with closure resin, the above-mentioned fluorescent substance is arranged on the above-mentioned closure resin.

[0058] According to the above-mentioned operation gestalt, since the above-mentioned fluorescent substance is arranged on the above-mentioned closure resin, the semi-conductor luminescence equipment which has desired luminescence wavelength is obtained by the amount of the still more nearly little fluorescent substance used rather than it is filled up with a fluorescent substance inside the crevice of the above-mentioned substrate. Moreover, with the above-mentioned closure resin, since the distance between the light-emitting part of a semi-conductor light emitting device and a fluorescent substance becomes abbreviation homogeneity, the semi-conductor luminescence equipment of homogeneity luminescence which does not almost have an irregular color is obtained. Moreover, since the above-mentioned closure resin makes a high order semi-conductor light emitting device and a fluorescent substance estrange, it can reduce the electric and thermal effect of a semi-conductor light emitting device to the above-mentioned fluorescent substance, and its engine performance of semi-conductor luminescence equipment is stable.

[0059] It is connected with metal wiring and the electric target of the above-mentioned substrate, and the above-mentioned semi-conductor light emitting device is equipped with the reflector which reflects a part of outgoing-radiation light [at least] from the above-mentioned semi-conductor light emitting device, the semi-conductor luminescence equipment of 1 operation gestalt is the substrate with which, as for the above-mentioned base, metal wiring was given, while closing the above-mentioned semi-conductor light emitting device, it has closure resin which the reflected light from the above-mentioned reflector penetrates, and the above-mentioned fluorescent substance is contained in the above-mentioned closure resin.

[0060] According to the above-mentioned operation gestalt, direct continuation of the above-mentioned semi-conductor light emitting device is done by the metal bump etc., without using metal wires, such as Au, and aluminum, Cu, for the semi-conductor light emitting device of the same configuration or a single class, connecting on metal wiring or using a metal wire etc. for the above-mentioned substrate. Therefore, the manufacture process of semi-conductor luminescence equipment is easy rather than it manufactures the semi-conductor luminescence equipment of a different configuration using the semi-conductor light emitting device of a different configuration [as / in the former] corresponding to the luminescent color. In this semi-conductor luminescence equipment, since the semi-conductor luminescence equipment which has desired luminescence wavelength only by arranging the predetermined fluorescent substance corresponding to desired wavelength is obtained, compared with the former, manufacture of semi-conductor luminescence equipment becomes simplicity and low cost.

[0061] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned base It is the substrate with which metal wiring was given. The above-mentioned semi-conductor light emitting device Connect with the above-mentioned metal wiring and the electric target of the above-mentioned substrate, and it has the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device. The exterior of semi-conductor luminescence equipment is equipped with the screen which interrupts the light which carries out direct outgoing radiation from the above-mentioned semi-conductor light emitting device, while closing the above-mentioned semi-conductor light emitting device, it has closure resin which the reflected light from the above-mentioned reflector penetrates, and the layer of the above-mentioned fluorescent substance is prepared in the field which light reflects in the above-mentioned reflector.

[0062] Since the layer of the above-mentioned fluorescent substance is prepared in the field which light reflects in the above-mentioned reflector according to the above-mentioned operation gestalt, wavelength conversion of the light reflected by this reflector is carried out certainly. And since it is reflected in the above-mentioned reflector and outgoing radiation of the outgoing radiation light from the above-mentioned semi-conductor light emitting device is carried out to the semi-conductor luminescence equipment exterior, without leaking to the exterior of semi-

conductor luminescence equipment by the above-mentioned screen, they is the light by which wavelength conversion of all was carried out. [most] Therefore, this semi-conductor luminescence equipment is formed only in a reflector, it is the amount of few fluorescent substances used, and the desired luminescent color is obtained efficiently. Furthermore, since the layer of the above-mentioned fluorescent substance is formed in the reflector of the reflector which makes a predetermined distance from a semi-conductor light emitting device, the distance between the light-emitting part of a semi-conductor light emitting device and a fluorescent substance becomes abbreviation homogeneity, and the semi-conductor luminescence equipment of homogeneity luminescence without an irregular color is obtained. Furthermore, since a semi-conductor light emitting device and a fluorescent substance are estranged, the electric and thermal effect of a semi-conductor light emitting device to a fluorescent substance is eased, and the engine performance of semi-conductor luminescence equipment is stabilized.

[0063] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned base It is the substrate with which metal wiring was given. The above-mentioned semi-conductor light emitting device Connect with the above-mentioned metal wiring and the electric target of the above-mentioned substrate, and a part for the light-emitting part of the above-mentioned semi-conductor light emitting device is arranged in the crevice of the above-mentioned substrate at least. It has the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device, while closing the above-mentioned semi-conductor light emitting device, it has closure resin which the reflected light from the above-mentioned reflector penetrates, and the layer of the above-mentioned fluorescent substance is prepared in the field which light reflects in the above-mentioned reflector.

[0064] According to the above-mentioned operation gestalt, since the semi-conductor light emitting device is arranged in the above-mentioned crevice, after wavelength conversion is surely reflected and carried out by the above-mentioned reflector in the exterior of semi-conductor luminescence equipment, without carrying out direct outgoing radiation, outgoing radiation of the light from a semi-conductor light emitting device is carried out to the exterior of semi-conductor luminescence equipment. Therefore, as for this semi-conductor luminescence equipment, the color tone of outgoing radiation light becomes good.

[0065] The semi-conductor luminescence equipment of 1 operation gestalt the above-mentioned base It is the substrate with which metal wiring was given. The above-mentioned semi-conductor light emitting device Connect with the above-mentioned metal wiring and the electric target of the above-mentioned substrate, and it has the reflector which reflects a part of outgoing radiation light [at least] from the above-mentioned semi-conductor light emitting device. While closing the above-mentioned semi-conductor light emitting device, it has closure resin which the reflected light from the above-mentioned reflector penetrates, and the layer of the above-mentioned fluorescent substance is prepared in the field as for which the light of the above-mentioned closure resin carries out outgoing radiation.

[0066] According to the above-mentioned operation gestalt, just before outgoing radiation is carried out from semi-conductor luminescence equipment, wavelength conversion of the outgoing radiation light from a semi-conductor light emitting device is carried out by the layer of the fluorescent substance prepared in the field as for which the light of the above-mentioned closure resin carries out outgoing radiation. That is, since wavelength conversion of all the light from this semi-conductor luminescence equipment is carried out, it becomes semi-conductor luminescence equipment of the utilization effectiveness of a good light. Moreover, since the layer of the above-mentioned fluorescent substance is in the location which kept a predetermined distance from the semi-conductor light emitting device, the distance between the light-emitting part of a semi-conductor light emitting device and a fluorescent substance becomes abbreviation homogeneity, and the semi-conductor luminescence equipment of homogeneity luminescence without an irregular color is obtained. Furthermore, since a semi-conductor light emitting device and a fluorescent substance are estranged, the electric and thermal effect of a semi-conductor light emitting device to a fluorescent substance is eased, and the engine performance of semi-conductor luminescence equipment is stabilized.

[0067] In the semi-conductor luminescence equipment with which the semi-conductor luminescence equipment of this invention comes to carry a semi-conductor light emitting device on a base the above-mentioned semi-conductor light emitting device It has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, and has the 1st fluorescent substance, the 2nd fluorescent substance, and the 3rd fluorescent substance. The 1st fluorescent substance of the above It has a red outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 600nm thru/or 670nm. The 2nd fluorescent substance of the above It has a green outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 500nm thru/or 540nm. The 3rd fluorescent substance of the above It has a blue outgoing radiation light which has the main luminescence peak to the wavelength field whose luminescence wavelength is 410nm thru/or 480nm, and the sum of the color of the outgoing radiation style from the 1st, 2nd, and 3rd fluorescent substance of the above is characterized by being a white system.

[0068] According to the above-mentioned configuration, the light in which the above-mentioned semi-conductor light emitting device has upwards the short wavelength field where human being's visibility is very low, and the above 1st thru/or the 3rd fluorescent substance carry out outgoing radiation Since it is the light of red, green, and the monochrome that has the main peak of luminescence wavelength respectively to a blue wavelength field Even if the above 1st thru/or the outgoing radiation light from the 3rd fluorescent substance and a direct outgoing radiation light from the above-mentioned semi-conductor light emitting device are mixed, if human being's visibility is taken into consideration, the color tone of the outgoing radiation light of semi-conductor luminescence equipment will

hardly change seemingly. That is, the above 1st thru/or the light from which [3rd] fluorescent substance are not influenced of the direct light from the above-mentioned semi-conductor light emitting device, either. Therefore, the semi-conductor luminescence equipment with which a color tone has the luminescent color of a good white system is obtained. Moreover, since color mixture is not carried out to the light from a fluorescent substance in human being's visible region, even if, as for the light by which direct outgoing radiation is carried out to the semi-conductor luminescence equipment exterior from a semi-conductor light emitting device about the outgoing radiation light of semi-conductor luminescence equipment, the luminescence engine performance of a semi-conductor light emitting device falls according to secular change after the activity of the long duration of semi-conductor luminescence equipment, it is only that the brightness of semi-conductor luminescence equipment falls, and a color tone does not change. Therefore, the light of a white system with a good color tone is stabilized by the above-mentioned semi-conductor luminescence equipment, and it is obtained.

[0069] Moreover, in the above-mentioned semi-conductor luminescence equipment, since the above-mentioned semi-conductor light emitting device has the outgoing radiation light whose luminescence wavelength is 390nm thru/or 420nm, it cannot damage the component part of semi-conductor luminescence equipments, such as closure resin, easily, for example, and does not almost have an operation harmful to the body. If the luminescence wavelength of a semi-conductor light emitting device is shorter than 390nm, the above-mentioned closure resin is damaged, for example, and inconvenience, such as opacification and melanism, may be produced. Therefore, by setting luminescence wavelength of the above-mentioned semi-conductor light emitting device to 390nm thru/or 420nm, degradation of the component part of semi-conductor luminescence equipment can be lessened, and there is almost no adverse effect in the body, and, moreover, semi-conductor luminescence equipment with a good color tone is obtained.

[0070] The semi-conductor luminescence equipment of 1 operation gestalt the 1st fluorescent substance of the above M2O2 S:Eu (however, any one or two or more elements with which M is chosen from La, Gd, and Y), 0.5MgF2 and 3.5 MgO-GeO2:Mn, Y2O3:Eu, It consists of any one or 2 or more Y(P, V) O4:Eu, YVO4:Eu, and among the groups of a fluorescent substance come out of and expressed. the 2nd fluorescent substance of the above RMg2aluminum16O27: -- Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) -- RMgAl10O17: -- Eu and Mn (however, any one as which R is chosen from Sr and Ba or both elements) -- It Eu(s) and D(ies). ZnS:Cu; SrAl2O4:Eu, and SrAl2O4: -- ZnO:Zn, Zn2germanium2O4:Mn, Zn2SiO4:Mn, and Q3MgSi2O8:Eu -- Mn It consists of any one or 2 or more however, (any one or two or more elements) with which Q is chosen from Sr, Ba, and calcium, and among the groups of a fluorescent substance come out of and expressed. the 3rd fluorescent substance of the above A10(PO4) 6Cl2:Eu (however, any one or two or more elements with which A is chosen from Sr, calcium, Ba, Mg, and Ce), XMg2aluminum16O27:Eu (however, any one as which X is chosen from Sr and Ba or both elements), XMgAl10O17:Eu (however, any one as which X is chosen from Sr and Ba or both elements), ZnS:Ag, Sr10(PO4) 6Cl2:Eu, calcium10(PO4) 6F2:Sb, Z3MgSi2O8:Eu (however, any one or two or more elements with which Z is chosen from Sr, Ba, and calcium), SrMgSi2O8:Eu, Sr2P2O7:Eu, and CaAl2O4: -- it consists of any one or 2 or more Eu, Nd, and among the groups of a fluorescent substance come out of and expressed.

[0071] According to the above-mentioned operation gestalt, even if it uses the semi-conductor light emitting device which has which luminescence wavelength of the inside whose luminescence wavelength is 390nm thru/or 420nm, red, monochromatic green, and a monochromatic blue luminescence light are respectively obtained by choosing a suitable fluorescent substance from two or more above-mentioned fluorescent substances corresponding to the luminescence wavelength of this semi-conductor light emitting device. Color mixture of the light of red and green and blue wavelength is respectively carried out appropriately by this, and the luminescent color of the white system of a good color tone is obtained. Moreover, since the light of the wavelength of all abbreviation for the wavelength field which a semi-conductor light emitting device has by combining two or more fluorescent substances is respectively convertible for red and green and blue wavelength, the utilization effectiveness of the outgoing radiation light of a semi-conductor light emitting device improves, and the semi-conductor luminescence equipment of efficient white system luminescence is obtained.

[0072] As for the 1st, 2nd, and 3rd fluorescent substance of the above, for the 1st fluorescent substance of the above, the 2nd fluorescent substance of the above is [the 3rd fluorescent substance of the above of the semi-conductor luminescence equipment of 1 operation gestalt] 30 or less % of the weight 20 % of the weight or more 70 or less % of the weight 50 % of the weight or more 20 or less % of the weight 7 % of the weight or more noting that a total amount is 100 % of the weight.

[0073] According to the above-mentioned operation gestalt, since 50-% of the weight or more 70 or less % of the weight and the 2nd fluorescent substance of the above are [7 % of the weight or more 20 or less % of the weight and the 3rd fluorescent substance of the above] 30 or less % of the weight 20 % of the weight or more for the 1st fluorescent substance of the above, the red in which the 1st fluorescent substance with low visibility carries out outgoing radiation compared with a green light in which the 2nd fluorescent substance of the above carries out outgoing radiation, and the blue luminous intensity the 3rd fluorescent substance carries out [luminous intensity] outgoing radiation are strengthened. Therefore, human being's visibility is taken into consideration and the semi-conductor luminescence equipment of white system luminescence of a good color tone is obtained.

[0074] In here, if there are more mixed ratios of the 1st fluorescent substance of the above than 70 % of the weight while it will turn into white of the color tone which green cut, if the luminescent color of semi-conductor luminescence equipment has few mixed ratios of the 1st fluorescent substance than 50 % of the weight, it will turn into white of the color tone which red cut. Moreover, the luminescent color of the above-mentioned semi-conductor

luminescence equipment turns into white of the color tone which red cut when there were few mixed ratios of the 2nd fluorescent substance than 7 % of the weight, and if there are more mixed ratios of the 2nd fluorescent substance of the above than 20 % of the weight, it will turn into white of the color tone which green cut. Moreover, the luminescent color of the above-mentioned semi-conductor luminescence equipment turns into white of the color tone which red cut when there were few mixed ratios of the 3rd fluorescent substance than 20 % of the weight, and if there are more mixed ratios of the 3rd fluorescent substance of the above than 30 % of the weight, it will turn into white of the color tone which green cut.

[0075] As for the above-mentioned closure resin, the semi-conductor luminescence equipment of 1 operation gestalt contains the 1st, 2nd, and 3rd fluorescent substance of the above, and the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance of the above to the weight of the above-mentioned closure resin is one or less [0.5 or more].

[0076] According to the above-mentioned operation gestalt, the semi-conductor luminescence equipment which carries out outgoing radiation of the light of the white system near the natural light is obtained by making the ratio of the AUW of the above-mentioned fluorescent substance to the weight of the above-mentioned closure resin or less [0.5 or more] into one. In addition, if the above-mentioned ratio becomes smaller than 0.5 while the brightness of the outgoing radiation light of semi-conductor luminescence equipment becomes bright and a color tone will become pale, if the above-mentioned ratio becomes larger than 1, while the brightness of the outgoing radiation light of semi-conductor luminescence equipment becomes dark, a color tone will wear redness.

[0077] The luminescence display of 1 operation gestalt is equipped with the light source which used the above-mentioned semi-conductor luminescence equipment, the light guide plate to which the light from the above-mentioned light source is led, and the light filter of green [which are made to penetrate the light from the above-mentioned light guide plate, and carry out a spectrum / the red and green], and blue, and the outgoing radiation light of the above-mentioned semi-conductor luminescence equipment has the wavelength distribution which suited the spectral characteristic of the above-mentioned light filter.

[0078] According to the above-mentioned operation gestalt, the outgoing radiation light from the above-mentioned semi-conductor luminescence equipment Since it has the above-mentioned red, green, and the wavelength distribution that suited the spectral characteristic of a blue light filter The light to which luminescence wavelength has a peak to a red wavelength field with this light filter, the light which has a peak to the wavelength field where luminescence wavelength is green, and the light which has a peak to the wavelength field where luminescence wavelength is blue — each — since it has suitable reinforcement and a spectrum is carried out — the utilization effectiveness of the light of semi-conductor luminescence equipment — good — moreover — high — it becomes a brightness luminescence display.

[0079] The luminescence display of 1 operation gestalt so that wavelength distribution of the outgoing radiation light of semi-conductor luminescence equipment may suit the spectral characteristic of the above-mentioned light filter The luminescence wavelength of the above-mentioned semi-conductor light emitting device, and the luminescence wavelength of the 1st fluorescent substance of the above, At least one of the luminescence wavelength of the 2nd fluorescent substance of the above, the luminescence wavelength of the 3rd fluorescent substance of the above, the mixed ratio of the 1st, 2nd, and 3rd fluorescent substance of the above, and the ratios of the AUW of the 1st, 2nd, and 3rd fluorescent substance of the above to the weight of the above-mentioned closure resin is adjusted.

[0080] Since according to the above-mentioned operation gestalt it is adjusted certainly and effectively so that the outgoing radiation light from the above-mentioned semi-conductor luminescence equipment may suit the spectral characteristic of the above-mentioned light filter, and the outgoing radiation light from the above-mentioned luminescence display has comparatively large reinforcement by the above-mentioned light filter and a spectrum is carried out to the red of abbreviation monochrome, green, and blue, the above-mentioned luminescence display does not have a color omission etc., and becomes the full color display of high brightness and high contrast.

[0081] The above-mentioned luminescence display of the luminescence display of 1 operation gestalt is a liquid crystal display.

[0082] According to the above-mentioned operation gestalt, there is almost no color omission and the liquid crystal display of high brightness and high contrast is obtained.

[0083]

[Embodiment of the Invention] Hereafter, the operation gestalt of a graphic display explains this invention to a detail.

[0084] Drawing 1 (a), (b), and (c) are the sectional views showing the semi-conductor light emitting device used in the operation gestalt of this invention.

[0085] Drawing 1 (a) is the sectional view showing the semi-conductor light emitting device which has the substrate which consists of an insulating semiconductor material. This semi-conductor light emitting device 7a is carrying out the laminating of the N type gallium nitride system compound semiconductor layer 2, the P type gallium nitride system compound semiconductor layer 3, and the electrode 4 for P type layers that consists of a metal thin film or transparence electric conduction film to order on insulating silicon-on-sapphire 1a. While the pad electrode 5 for N type is formed on the exposed surface formed in right-hand side in drawing 1 (a) of the above-mentioned N type gallium nitride system compound semiconductor layer 2, the pad electrode 6 for P type is formed on the above-mentioned electrode 4 front face for P type layers. If a current is passed between the above-mentioned pad electrode 5 for N type, and the pad electrode 6 for P type, light will be emitted from luminescence field 8a.

[0086] Drawing 1 (b) is the sectional view showing the semi-conductor light emitting device which has the substrate

which consists of a conductive semiconductor material. On conductive gallium nitride semi-conductor substrate 1b, this semi-conductor light emitting device 7b carries out the laminating of the electrode 4 for P type layers which consists of the N type gallium nitride system compound semiconductor layer 2, the P type gallium nitride system compound semiconductor layer 3, a metal thin film, or transparence electric conduction film one by one, and is formed. While the pad electrode 5 for N type is formed in the underside of the above-mentioned semi-conductor substrate 1b, the pad electrode 6 for P type is formed in the top face of the above-mentioned electrode 4 for P type layers. If a current is passed between the above-mentioned pad electrode 5 for N type, and the pad electrode 6 for P type, light will be emitted from luminescence field 8b.

[0087] Drawing 1 (c) is the sectional view showing the semi-conductor light emitting device of the type which is made to penetrate a substrate and takes out light. This semi-conductor light emitting device 7c on insulating silicon-on-sapphire 1a (it sets to drawing 1 (c) and is the lower part of silicon-on-sapphire 1a) The laminating of the electrode 4 for P type layers which consists of the N type gallium nitride system compound semiconductor layer 2, the P type gallium nitride system compound semiconductor layer 3, a metal thin film, or transparence electric conduction film is carried out one by one. While forming the pad electrode 5 for N type in the exposed surface of the above-mentioned N type gallium nitride system compound semiconductor layer 2, the pad electrode 6 for P type is formed in the front face of the electrode 4 for P type layers. And as shown in drawing 1 (c), direct ball bonding of the above-mentioned pad electrode 5 for N type and the pad electrode 6 for P type is carried out to metal wiring of submounting which has been arranged under the semi-conductor light emitting device 7c and which is not illustrated etc. by the metal bumps 16a and 16b who consist of Au etc. If a current is passed between the above-mentioned pad electrode 5 for N type, and the pad electrode 6 for P type, light is emitted from the luminescence field 8, and this luminescence light will penetrate the above-mentioned silicon-on-sapphire 1a, and will be emitted up in drawing 1 (c).

[0088] In addition, other ingredients, such as ZnO, GaN, SiC, and ZnSe, may be used for insulating silicon-on-sapphire 1a of the above-mentioned semi-conductor light emitting devices 7a and 7c. Moreover, other ingredients, such as SiC, ZnSe, and Si, may be used for conductive gallium nitride semi-conductor substrate 1b in the above-mentioned semi-conductor light emitting device 7b. Semi-conductor light emitting device 7b equipped with this conductive semi-conductor substrate 1b Since an electrode is formed also in the underside of the above-mentioned semi-conductor substrate 1b and an electrode can be formed in vertical both sides of semi-conductor light emitting device 7b Compared with the semi-conductor light emitting devices 7a and 7b which have insulator substrate 1a and arrange two electrodes on one side, while being able to form the luminescence field of a semi-conductor layer widely in the same size, there is an advantage that mounting to a leadframe or a mounting substrate is easy.

[0089] As an ingredient of the semi-conductor layer in the above-mentioned semi-conductor light emitting devices 7a, 7b, and 7c, although a nitride system compound semiconductor ($In_xGa_yAl_zN$ ($x+y+z=1$, $0<=x<=1$, $0<=y<=1$, $0<=z<=1$)) can use suitably, semiconductor materials, such as SiC and ZnSe, may be used in addition to it.

[0090] As for the above-mentioned semi-conductor light emitting devices 7a, 7b, and 7c, a wavelength field emits light in the light from 390nm to 420nm. Since human being's visibility to the light of this wavelength field is very low, if the fluorescent substance which changes the light of this wavelength field into the light of other wavelength is used, only the color of the light changed by this fluorescent substance will be recognized as the luminescent color, and the semi-conductor luminescence equipment which has a good color tone will be obtained. If the wavelength of a semi-conductor light emitting device is longer than 420nm, it becomes human being's eyes that it is easy to be recognized as the light, and the light by which wavelength conversion was carried out with the fluorescent substance will be mixed with a direct outgoing radiation light from a semi-conductor light emitting device, and the color tone of the luminescent color will worsen. Moreover, if the wavelength of a semi-conductor light emitting device is shorter than 390nm, this light will carry out melanism of the mould resin as opposed to the resin part currently used for semi-conductor luminescence equipment, and will do the adverse effect of reducing brightness, or deteriorating resin and reducing dependability while it becomes ultraviolet rays harmful to the body.

[0091] Next, the fluorescent substance used for the semi-conductor luminescence equipment of this invention is stated to a detail.

[0092] A following table 1 and a following table 2 are a table having shown the result of having excited various fluorescent substances and having evaluated luminescence brightness using the semi-conductor light emitting device which created the gallium nitride system compound semiconductor whose peak of luminescence wavelength is 410nm as a light emitting device. Moreover, the peak wavelength (nm) of luminescence which excited the above-mentioned fluorescent substance and was obtained is shown simultaneously. In red, green, blue, a bluish green color, and each orange luminescent color, assessment of the brightness of luminescence measured the luminescence brightness for every fluorescent substance, evaluated superiority or inferiority, and gave x to what is inferior to what luminescence brightness is inferior to an excellent thing in O, and is a little inferior to an ordinary thing in O in **. The luminescent color shows red, the peak wavelength about a green fluorescent substance, and the assessment result of brightness, and, as for a table 1, the luminescent color shows blue and a bluish green color, the peak wavelength about an orange fluorescent substance, and the assessment result of brightness, as for a table 2.

[0093]

[A table 1]

発光色	蛍光体	発光ピーク波長（nm）	評価
赤色	$La_2O_2S:Eu$	623	◎
	$Gd_2O_2S:Eu$	625	○
	$Y_2O_2S:Eu$	626	△
	$0.5MgF_2 \cdot 3.5MgO \cdot GeO_2:Mn$	658	◎
	$Y_2O_3:Eu$	611	△
	$Y(P,V)O_4:Eu$	618	△
	$YVO_4:Eu$	618	△
	$CaS:Eu$	655	○
	$CaS:Eu,Tm$	650	◎
緑色	$BaMg_2Al_{10}O_{27}:Eu,Mn$	515	○
	$BaMgAl_{10}O_{17}:Eu,Mn$	512	○
	$ZnS:Cu$	527	△
	$SrAl_2O_4:Eu$	522	◎
	$SrAl_2O_4:Eu,Dy$	522	○
	$ZnO:Zn$	508	△
	$Zn_2Ge_2O_4:Mn$	537	○
	$Zn_2SiO_4:Mn$	525	○
	$Ba_3MgSi_2O_8:Eu,Mn$	512	○
	$Sr_3MgSi_2O_8:Eu,Mn$	532	○

[0094]
[A table 2]

発光色	蛍光体	発光ピーク波長 (nm)	評価
青色	$(Sr, Ca, Ba, Ce)_{10}(PO_4)_6Cl_2:Eu$	457	◎
	$BaMg_2Al_{16}O_{27}:Eu$	455	◎
	$BaMgAl_{10}O_{17}:Eu$	452	○
	$ZnS:Ag$	450	△
	$Sr_{10}(PO_4)_6Cl_2:Eu$	447	○
	$Ca_{10}(PO_4)_6F_2:Sb$	480	△
	$Sr_3MgSi_2O_8:Eu$	462	○
	$SrMgSi_2O_8:Eu$	460	△
	$SrAl_{12}O_{19}:Eu$	400	×
	$Sr_2P_2O_7:Eu$	420	△
	$CaAl_2O_4:Eu, Nd$	440	△
青緑色	$Sr_4Al_{14}O_{25}:Eu$	492	◎
	$Sr_4Al_{14}O_{25}:Eu, Dy$	492	◎
	$(Ba, Ca, Mg)_{10}(PO_4)_6Cl_2:Eu$	482	○
	$Sr_2Si_3O_8 \cdot 2SrCl_2:Eu$	490	△
橙色	$ZnS:Mn$	586	○
	$ZnS:Cu, Mn, Co$	580	○

As shown in a table 1, in order to obtain the luminescent color of the red of high brightness, the fluorescent substance of La2O2 S:Eu, 0.5MgF2 and 3.5 MgO-GeO2:Mn, CaS:Eu, and Tm is suitable, and in order to obtain the green luminescent color of high brightness, the fluorescent substance of SrAl2O4:Eu is suitable. moreover -- as shown in a table 2, in order the fluorescent substance of 10(Sr, calcium, Ba, Ce) (PO4) 6Cl2:Eu is suitable in order to obtain the blue luminescent color of high brightness and to obtain the luminescent color of the bluish green color of high brightness -- Sr4aluminum14O25:Eu and Sr4aluminum14O25: -- the fluorescent substance of Eu and Dy is suitable.

[0095] Drawing 2 thru/or 7 are drawings having shown the emission spectrum and excitation spectrum of the main fluorescent substances which are used for the operation gestalt of this invention. An axis of abscissa is wavelength (nm) and any drawing of an axis of ordinate is relative intensity (%).

[0096] The luminescence wavelength of the semi-conductor light emitting device used for this invention is 390nm thru/or 420nm. The more nearly optimal luminescence wavelength range changes with the class of fluorescent substance excited by the luminescence wavelength of a semi-conductor light emitting device, and the luminescent color of a fluorescent substance.

[0097] For example, when it is going to obtain the luminescent color of the red which has a luminescence wavelength peak in 658nm by fluorescent substance 0.5MgF2 and 3.5 MgO-GeO2:Mn shown in drawing 2 (a), it is effective for the wavelength range of 410nm thru/or 420nm to excite the above-mentioned fluorescent substance by the semi-conductor light emitting device which has the peak of luminescence wavelength so that clearly from drawing 2 (b).

[0098] It is effective to, excite the above-mentioned fluorescent substance on the other hand, by the semi-conductor light emitting device which has the luminescence wavelength of 390nm so that clearly from drawing 3 (b) when it is going to obtain the luminescent color of the red which is fluorescent substance La2O2 S:Eu shown in drawing 3 (a), and has a luminescence wavelength peak in 623nm.

[0099] Originally, although the peak of the excitation wavelength of fluorescent substance 0.5MgF2, 3.5 MgO-GeO2:Mn, and La2O2 S:Eu is in a short wavelength side from 390nm If the luminescence wavelength of the semi-conductor light emitting device which excites a fluorescent substance is shorter than 390nm Since ultraviolet rays harmful to the body will be emitted, it is not practical, and ****** is also given to the resin part currently used for semi-conductor luminescence equipment, and it becomes the cause of lowering of the brightness by the melanism of closure resin, or lowering of the dependability by deterioration of resin.

[0100] Besides the above-mentioned fluorescent substance, Gd2O2 S:Eu, Y2O2 S:Eu, Y2O3:Eu, Y(P, V) O4:Eu, YVO4:Eu, etc. are available with the operation gestalt of this invention. Moreover, these fluorescent substances can be more effectively changed into the light of the red whose peaks of luminescence wavelength are 600nm thru/or 670nm by using more than one using the outgoing radiation light of a semi-conductor light emitting device.

[0101] moreover, fluorescent substance BaMg2aluminum16O27: shown in drawing 4 (a) — it is Eu and Mn, and when it is going to obtain the green luminescent color which has a luminescence wavelength peak in 515nm, it is effective to excite the above-mentioned fluorescent substance by the semi-conductor light emitting device which has the luminescence wavelength of 390nm so that clearly from drawing 4 (b).
[0102] It is effective for the wavelength range of 390nm thru/or 420nm to excite the above-mentioned fluorescent substance by the semi-conductor light emitting device which has the peak of luminescence wavelength so that clearly [, on the other hand, it is fluorescent substance SrAl2O4:Eu shown in drawing 5 (a), and] from drawing 5 (b), when it is going to obtain the green luminescent color which has a luminescence wavelength peak in 522nm.
[0103] original -- fluorescent substance BaMg2aluminum16O27:, although the peak of the excitation wavelength of Eu, Mn, and SrAl2O4:Eu is in a short wavelength side from 390nm If the luminescence wavelength of the semi-conductor light emitting device which excites a fluorescent substance is shorter than 390nm Since ultraviolet rays harmful to the body will be emitted, it is not practical, and it has an adverse effect also on the resin part currently used for semi-conductor luminescence equipment, and becomes the cause of lowering of the brightness by the melanism of closure resin, or lowering of the dependability by deterioration of resin.
[0104] except for the above-mentioned fluorescent substance — the operation gestalt of this invention — ZnS:Cu and SrAl2O4: -- Eu, Dy, ZnO:Zn, Zn2germanium2O4:Mn, Zn2SiO4:Mn, and Ba3MgSi2O8: — Eu, Mn, and Sr3MgSi2O8: — Eu, Mn, etc. are available. Moreover, these fluorescent substances can be more effectively changed into a green light whose peaks of luminescence wavelength are 500nm thru/or 540nm by using more than one using the outgoing radiation light of a semi-conductor light emitting device.
[0105] Moreover, when it is going to obtain the blue luminescent color which has a luminescence wavelength peak in 457nm, it is effective [it is fluorescent substance (Sr, calcium, Ba, Ce) 10(PO4) 6Cl2:Eu shown in drawing 6 (a), and] for the wavelength range of 390nm thru/or 400nm to excite the above-mentioned fluorescent substance by the semi-conductor light emitting device which has the peak of luminescence wavelength so that clearly from drawing 6 (b). Originally, although the peak of the excitation wavelength of fluorescent substance (Sr, calcium, Ba, Ce) 10(PO4) 6Cl2:Eu is in a short wavelength side from 390nm If the luminescence wavelength of the semi-conductor light emitting device which excites a fluorescent substance is shorter than 390nm Since ultraviolet rays harmful to the body will be emitted, it is not practical, and it has an adverse effect also on the resin part currently used for semi-conductor luminescence equipment, and becomes the cause of lowering of the brightness by the melanism of closure resin, or lowering of the dependability by deterioration of resin.
[0106] It is effective to, excite the above-mentioned fluorescent substance on the other hand, by the semi-conductor light emitting device which has the luminescence wavelength of 390nm so that clearly [it is fluorescent substance BaMgAl10O17:Eu shown in drawing 7 (a), and] from drawing 7 (b), when it is going to obtain the blue luminescent color which has a luminescence wavelength peak in 452nm. Since ultraviolet rays harmful to the body will be emitted when the luminescence wavelength of the semi-conductor light emitting device which excites a fluorescent substance is originally shorter than 390nm, although the peak of the excitation wavelength of fluorescent substance BaMgAl10O17:Eu is in 390nm, it is not practical, and it has an adverse effect also on the resin part currently used for semi-conductor luminescence equipment, and becomes the cause of lowering of the brightness by the melanism of closure resin, or lowering of the dependability by deterioration of resin.
[0107] except for the above-mentioned fluorescent substance — the operation gestalt of this invention — BaMg2aluminum16O27:Eu, ZnS:Ag, and Sr10(PO4) 6Cl2: — Eu, calcium10(PO4) 6F2:Sb, Sr3MgSi2O8:Eu, SrMgSi2O8:Eu, Sr2P2O7:Eu, and CaAl2O4: -- Eu, Nd, etc. are available. Moreover, the outgoing radiation light of a semi-conductor light emitting device can be more effectively changed into a blue light whose peaks of luminescence wavelength are 410nm thru/or 480nm by using two or more these fluorescent substances.
[0108] It Eu(s) and D(ies). furthermore, an activity application — responding — Sr4aluminum14O25:Eu and Sr4aluminum14O25: — Any one of fluorescent substances, such as 10(PO4) 6Cl2:Eu, and Sr2Si3O8, 2SrCl2:Eu, (Ba, calcium, Mg) Or the outgoing radiation light of a semi-conductor light emitting device is effectively convertible for the light of the bluish green color whose peaks of luminescence wavelength are 480nm thru/or 500nm by using plurality.
[0109] Moreover, the outgoing radiation light of a semi-conductor light emitting device is convertible for a fluorescent substance by using ZnS:Mn, ZnS:Cu, and Mn and Co at an orange light whose peaks of luminescence wavelength are 570nm thru/or 600nm.
[0110] Hereafter, the semi-conductor luminescence equipment of the operation gestalt of this invention is explained in detail with reference to a drawing.
[0111] (1st operation gestalt) Drawing 8 (a) thru/or (c) are the sectional views showing the semi-conductor luminescence equipment of the 1st operation gestalt of this invention.
[0112] Drawing 8 (a) is the sectional view of the ramp-type semi-conductor luminescence equipment which closed the above-mentioned semi-conductor light emitting device 7a with the mould resin as closure resin of the shape of ramp type which it had [shape] semi-conductor light emitting device 7a which has an insulating substrate, and distributed the fluorescent substance.
[0113] This semi-conductor luminescence equipment has mounting section 10a which is the depression of a cup configuration at the head of the leadframe 101 as a base. The above-mentioned semi-conductor light emitting device 7a is being fixed to mounting section 10a of this cup configuration with the adhesives 11 which consist of an epoxy resin etc. P lateral electrode 6a prepared in the top face of the above-mentioned semi-conductor light emitting device 7a is connected to polar-zone 10b of a leadframe 101 by metal wire 6p which consists of Au,

aluminum, Cu, etc. Moreover, N lateral electrode 5a prepared in the top face of the above-mentioned semi-conductor light emitting device 7a is connected to polar-zone 10c of the right-hand side leadframe 102 by metal wire 5n. And the upper part of above-mentioned semi-conductor light emitting device 7a and a leadframe 101,102 is closed with the mould resin 130 which distributed the fluorescent substance, such as an epoxy resin of translucency, and ramp type-like semi-conductor luminescence equipment is formed. In addition, the adhesives 11 which join the above-mentioned semi-conductor light emitting device 7a and mounting section 10a of a leadframe 101 will not be limited especially if it is the ingredient which does not absorb the light from semi-conductor light emitting device 7a. For example, the resin ingredient containing the ingredient which reflects and scatters the other light efficiently etc. may be used for mounting section 10a of a leadframe 101 from the resin ingredient which mixed the thermally conductive good metallic material for the heat-characteristic improvement of the above-mentioned semi-conductor light emitting device 7a, and above-mentioned semi-conductor light emitting device 7a.

[0114] Drawing 8 (b) is the sectional view of the ramp-type semi-conductor luminescence equipment which closed the above-mentioned semi-conductor light emitting device 7b with the mould resin 130 as closure resin of the shape of ramp type which it had [shape] semi-conductor light emitting device 7b which has a conductive substrate, and distributed the fluorescent substance. Among drawing, the part which has the same function as the semi-conductor luminescence equipment shown in drawing 8 (a) attaches the same reference number, and omits detailed explanation.

[0115] As for this semi-conductor luminescence equipment, direct continuation of the N lateral electrode section 5of above-mentioned semi-conductor light emitting device 7b b is carried out to mounting section 10a of a leadframe 101 by the adhesives 15 which consist of the conductive wax material or Au-epoxy resin which consists of metal systems, such as an indium, an Ag-epoxy resin, etc. On the other hand, P lateral electrode 6b prepared in the top face of the above-mentioned semi-conductor light emitting device 7b is connected to polar-zone 10c of the right-hand side leadframe 102 by metal wire 6p in drawing 8 (b). And the upper part of above-mentioned semi-conductor light emitting device 7b and a leadframe 101,102 is closed with the mould resin 130 which distributed the fluorescent substance, and forms ramp type-like semi-conductor luminescence equipment. Since the electrodes 6b and 5b with which semi-conductor light emitting device 7b was prepared up and down are the same as that of the semi-conductor light emitting device of the conventional GaAs system or a GaP system, the leadframe used for conventional semi-conductor luminescence equipment can be used as it is.

[0116] Drawing 8 (c) is the sectional view of the ramp-type semi-conductor luminescence equipment which closed the above-mentioned semi-conductor light emitting device 7c with the mould resin 130 as closure resin of the shape of ramp type which it had [shape] semi-conductor light emitting device 7c which has an insulating substrate, and this semi-conductor light emitting device 7c and leadframe 103,103 were connected [shape], without using a metal wire, and distributed the fluorescent substance.

[0117] This semi-conductor luminescence equipment has connected the submounting 17 as a base at the head of the leadframe 103,103 which countered mutually and has been arranged. This submounting 17 consists of Si, it is insulation and the electrode wiring 17a and 17b is formed in the top face of the submounting 17. The above-mentioned semi-conductor light emitting device 7c makes a semi-conductor layer side face (bottom side of semi-conductor light emitting device 7c in drawing 1 (c)) counter the top face of this submounting 17, and is carried in it. P lateral electrode 6c and N lateral electrode 5c which were prepared in the bottom side of the above-mentioned semi-conductor light emitting device 7c are connected to the electrode wiring 17a and 17b formed in the top face of the above-mentioned submounting 17 using Au bump etc. It connected with the points 10d and 10e of a leadframe, and the electrode wiring 17a and 17b formed in the top face of the above-mentioned submounting 17 is connected to the exterior and an electric target. And it closes with the mould resin 130 which consists a fluorescent substance of a distributed epoxy resin in above-mentioned semi-conductor light emitting device 7c and the submounting 17, and the upper part of a leadframe 103,103, and ramp type-like semi-conductor luminescence equipment is formed. Since this semi-conductor luminescence equipment is carrying out direct continuation of the above-mentioned semi-conductor light emitting device 7c to the submounting 17, it has the advantage that the heat from the luminescence field of the above-mentioned semi-conductor light emitting device 7c can be quickly missed to the exterior of semi-conductor luminescence equipment through the submounting 17 and a leadframe 103,103.

[0118] The semi-conductor luminescence equipment of the shape of ramp type shown in drawing 8 (a), (b), and (c) The light emitted has the other directivity above drawing 8 (a), (b), and (c). Especially the semi-conductor luminescence equipment of drawing 8 (a) and (b) Since the light by which outgoing radiation was carried out from the semi-conductor light emitting devices 7a and 7b is condensed efficiently, mounting section 10a of a leadframe 101 is formed in the cup configuration. The thermosetting which has the translucency of silicon resin, urethane resin, polycarbonate resin, etc. in addition to an epoxy resin, and thermoplastic resin may be used for the above-mentioned mould resin 130. Moreover, although the mould resin 130 whole may be made to distribute the above-mentioned fluorescent substance to homogeneity, if the content ratio of a fluorescent substance is gradually made high toward the semi-conductor light emitting devices 7a, 7b, and 7c from the front face of mould resin 130, degradation of the fluorescent substance under the effect of the moisture from the outside of mould resin 130 etc. can be reduced. moreover, the fluorescent substance by the semi-conductor light emitting devices 7a, 7b, and 7c if the content ratio of a fluorescent substance is gradually made high toward the front face of mould resin 130 from the semi-conductor light emitting devices 7a, 7b, and 7c -- electric and thermal effect can also be eased. Thus, distribution of the fluorescent substance in mould resin 130 can make various gestalten according to the class of mould resin, the class of fluorescent substance, an operating environment, conditions, or an application.

[0119] (2nd operation gestalt) Drawing 9 (a) and (b) are the sectional views having shown the semi-conductor luminescence equipment in the 2nd operation gestalt of this invention. The semi-conductor luminescence equipment of drawing 9 (a) is the same as the semi-conductor luminescence equipment shown in drawing 8 (a) except mould resin 131 not containing a fluorescent substance while being filled up with a fluorescent substance in mounting section 10a of a leadframe 101. Also about the semi-conductor luminescence equipment of drawing 9 (b), while being filled up with a fluorescent substance in mounting section 10a of a leadframe 101, it is the same as that of the semi-conductor luminescence equipment shown in drawing 8 (b) except mould resin 131 not containing a fluorescent substance. Therefore, the same reference number is given to the part which has the same function as the semi-conductor luminescence equipment shown in drawing 8 (a) and (b), and detailed explanation is omitted. Also in other following operation gestalten, it is the same.

[0120] While the semi-conductor luminescence equipment shown in drawing 9 (a) and (b) arranges the semi-conductor light emitting devices 7a and 7b at the bottom of mounting section 10a of a cup configuration, it fills up this mounting section 10a with a fluorescent substance 12, and he is trying to change the wavelength of the light from the semi-conductor light emitting devices 7a and 7b with this fluorescent substance 12. That is, by arranging the above-mentioned fluorescent substance 12 to mounting section 10a which collects the light from the semi-conductor light emitting devices 7a and 7b, it does not leak, the light from the semi-conductor light emitting devices 7a and 7b is transformed, and the conversion efficiency of light is raised. Therefore, compared with the case where the whole mould resin [as / in the operation gestalt of the above 1st] is made to distribute a fluorescent substance, the color tone of semi-conductor luminescence equipment is good, and since what is necessary is to arrange a fluorescent substance only in mounting section 10a moreover, the amount of the fluorescent substance used is reduced.

[0121] In the above-mentioned operation gestalt, although filled up with the fluorescent substance 12 in [of a leadframe 101 / whole] mounting section 10a, as long as the bleedoff light from the semi-conductor light emitting devices 7a and 7b is convertible for wavelength predetermined enough, you do not need to make it filled up with a fluorescent substance 12 in [whole] mounting section 10a not necessarily, and a concave may be filled up with a fluorescent substance 12 in mounting section 10a. Or what is necessary is to have been filled up with the fluorescent substance 12 so that it might rise to convex rather than the above-mentioned mounting section 10a upper bed, and just to, have filled up mounting section 10a with the fluorescent substance 12 of an amount which can change the wavelength of the light from the semi-conductor light emitting devices 7a and 7b into desired wavelength in short.

[0122] (3rd operation gestalt) Drawing 10 (a) and (b) are the sectional views showing the semi-conductor luminescence equipment of the 3rd operation gestalt of this invention. The semi-conductor luminescence equipment of drawing 10 (a) is the same as the semi-conductor luminescence equipment shown in drawing 9 (a) in mounting section 10a of a leadframe 101 except having arranged pre coating 13a so that the whole semi-conductor light emitting device 7a may be covered, and having arranged the fluorescent substance 12 on it. It is the same as that of the semi-conductor luminescence equipment shown in drawing 9 (b) except having arranged pre coating 13a so that the whole semi-conductor light emitting device 7a may be covered in mounting section 10a of a leadframe 101, and having arranged the fluorescent substance 12 on it also about the semi-conductor luminescence equipment of drawing 10 (b). Therefore, the same reference number is given to the part which has the same function as the semi-conductor luminescence equipment shown in drawing 9 (a) and (b), and detailed explanation is omitted.

[0123] In drawing 10 (a) and (b), pre coating 13a which consists of an epoxy resin, silicon resin, urethane resin, etc. so that the semi-conductor light emitting devices 7a and 7b may be arranged and this semi-conductor light emitting device 7a and the whole 7b may be covered is formed in the bottom of mounting section 10a of the cup configuration formed at left-hand side leadframe 101 head. The fluorescent substance 12 is arranged in the shape of a layer so that the above-mentioned mounting section 10a inside may be filled on this pre coating 13. The above-mentioned fluorescent substance 12 carries out dipping of the mounting section 10a in which pre coating 13a was formed, or forms it on the pre coating 13 potting or the fuel spray, and by vapor-depositing on pre coating 13a in mounting section 10a. In drawing 10 (a) and (b), although the fluorescent substance 12 was formed only inside [mounting section 10a] the leadframe 101, you may form so that all the top faces of a leadframe 101 may be covered.

[0124] The above-mentioned fluorescent substance 12 sets the abbreviation equal distance by pre coating 13a from the luminescence field of the semi-conductor light emitting devices 7a and 7b, and the semi-conductor luminescence equipment shown in drawing 10 (a) and (b) is formed in homogeneity thickness. Therefore, a uniform luminescence light in which this semi-conductor luminescence equipment does not have nonuniformity is obtained by that abbreviation etc. requires the quantity of light passed in all the fields of a fluorescent substance 12 by carrying out. Moreover, since a fluorescent substance 12 is arranged in the location estranged from the semi-conductor light emitting devices 7a and 7b, the electric and thermal effect of a semi-conductor light emitting device to a fluorescent substance 12 can be eased. Consequently, a luminescence property is good and, moreover, semi-conductor luminescence equipment with sufficient endurance is obtained.

[0125] (4th operation gestalt) Drawing 11 (a) and (b) are the sectional views showing the semi-conductor luminescence equipment by the 4th operation gestalt of this invention.

[0126] Drawing 11 (a) carries semi-conductor light emitting device 7a which has an insulating substrate on the printed-circuit board 18 as a base, and is closing the above-mentioned semi-conductor light emitting device 7a with the mould resin 132 as closure resin which distributed the fluorescent substance.

[0127] This semi-conductor luminescence equipment has pasted up semi-conductor light emitting device 7a with the adhesives 11 which consist of an epoxy resin on the printed-circuit board 18 of the rectangular parallelepiped configuration which consists of glass epoxy which has thermal resistance. P lateral electrode 6a and N lateral electrode 5a which were prepared in the top face of this semi-conductor light emitting device 7a are respectively connected to the polar zone 18a and 18b of printed-circuit board 18 top face by the metal wires 6p and 5n. Through the through hole of the shape of cross-section radii which connects the top face and underside of a printed-circuit board 18 which is not illustrated, these polar zone 18a and 18b was taken about on the underside of the printed-circuit board 18 as a component side, and is prolonged even to the both ends of this component side. In addition, an insulating film may be used for the above-mentioned printed-circuit board 18.

[0128] And on the above-mentioned printed-circuit board 18, it forms so that a parabolic edge section as shows the mould resin 132 which distributed the fluorescent substance, such as an epoxy resin as closure resin (for example, translucency), to drawing 11 (a) may be made, and the semi-conductor luminescence equipment of a chip part shape is formed so that the above-mentioned whole semi-conductor light emitting device 7a may be covered.

[0129] The adhesives 11 on which the above-mentioned semi-conductor light emitting device 7a and a printed-circuit board 18 are pasted up will not be limited especially if it is the ingredient with which the light from semi-conductor light emitting device 7a is not absorbed. For example, the resin ingredient which mixed the thermally conductive good metallic material for the heat-characteristic improvement of semi-conductor light emitting device 7a, the resin ingredient containing the ingredient which reflects and scatters efficiently the light emitted toward the printed-circuit board 18 from semi-conductor light emitting device 7a, etc. may be used. However, to use the resin ingredient containing a metallic material, it is necessary to take care that P lateral electrode 6a and N lateral electrode 5a do not connect too hastily.

[0130] Drawing 11 (b) is the same as that of the semi-conductor luminescence equipment of drawing 11 (a) except having semi-conductor light emitting device 7c which changes to semi-conductor light emitting device 7a in drawing 11 (a), and has an insulating substrate. Therefore, the same reference number is given to the part which has the same function as drawing 11 (a), and detailed explanation is omitted.

[0131] In the semi-conductor luminescence equipment of drawing 11 (b), semi-conductor light emitting device 7c carries out outgoing radiation of the light through the insulating substrate located in an upside in drawing 11 (b) of semi-conductor light emitting device 7c. The above-mentioned semi-conductor light emitting device 7c is carrying out direct continuation of P lateral electrode 6c and N lateral electrode 5c which were formed in the semi-conductor laminating side which is the bottom in drawing 11 (b) to the polar zone 18a and 18b on a printed-circuit board 18 respectively through Au bump. In addition, semi-conductor light emitting device 7c may be carried in submounting which consists of Si beforehand given to metal wiring, and this submounting may be electrically connected to a printed-circuit board 18 with die bond, wire bond, etc. Since this semi-conductor luminescence equipment turns the field by the side of a semi-conductor laminating to a printed-circuit board 18 and mounts semi-conductor light emitting device 7c, it can miss quickly the heat from the luminescence field of the above-mentioned semi-conductor light emitting device 7c to the exterior.

[0132] The thermosetting which has the translucency of silicon resin, urethane resin, Pori force-BONETO resin, etc. in addition to an epoxy resin, and thermoplastic resin may be used for the mould resin 132 in the semi-conductor luminescence equipment of drawing 11 (a) and (b). Moreover, although the mould resin 132 whole may be made to distribute a fluorescent substance to homogeneity, if the content ratio of a fluorescent substance is gradually made high toward a semi-conductor light emitting device from the front face of mould resin 132, degradation of the fluorescent substance under the effect of moisture etc. can be reduced. Moreover, if the content ratio of a fluorescent substance is gradually made high toward the front face of mould resin 132 from the semi-conductor light emitting devices 7a and 7c, the electric and thermal effect of the semi-conductor light emitting devices 7a and 7c to a fluorescent substance can be eased. Thus, distribution of the fluorescent substance in mould resin 132 can make various gestalten according to the class of mould resin, the class of fluorescent substance, an operating environment, conditions, an application, etc.

[0133] In addition, it may change to the above-mentioned semi-conductor light emitting devices 7a and 7c, and semi-conductor light emitting device 7b which has a conductive substrate may be used. In this case, direct continuation of the N type electrode formed in the underside of semi-conductor light emitting device 7b is carried out to one electrode on a printed-circuit board with the adhesives which have conductivity. P lateral electrode prepared in the top face of the above-mentioned semi-conductor light emitting device 7b is connected to the polar zone of another side on a printed-circuit board with a metal wire. Like the semi-conductor luminescence equipment of the conventional GaAs system or a GaP system, since the above-mentioned semi-conductor light emitting device 7b has an electrode to vertical both sides of semi-conductor light emitting device 7b, it has the advantage that the conventional leadframe can be used as it is.

[0134] (5th operation gestalt) Drawing 12 (a) and (b) are the sectional views showing the semi-conductor luminescence equipment of the 5th operation gestalt of this invention. The semi-conductor luminescence equipment of drawing 12 (a) is equipped with the frame 19 which consists of resin on the printed-circuit board 18 as a base. Semi-conductor light emitting device 7b which is on this printed-circuit board 18, and has a conductive substrate inside the above-mentioned resin frame 19 is arranged. And it is filled up with the mould resin 134 as closure resin which contains a fluorescent substance inside the above-mentioned resin frame 19, and semi-conductor light emitting device 7b is closed.

[0135] This semi-conductor luminescence equipment has formed the frame 19 which consists of resin on the

printed circuit board 18 of the rectangular parallelepiped configuration which consists of glass epoxy which has thermal resistance. When this resin frame 19 is filled up with mould resin 134 inside, it has the height whose resin 134 is fully wrap extent about semi-conductor light emitting device 7b. In the inside of this frame 19, one polar-zone 18a on a printed-circuit board 18 and N lateral electrode 5b under semi-conductor light emitting device 7b are pasted up and connected with the adhesives which have conductivity. On the other hand, P lateral electrode 6b prepared in the top face of semi-conductor light emitting device 7b is connected to polar-zone 18b of another side on a printed-circuit board 18 by metal wire 6p. Through the through hole of the shape of cross-section radii which penetrates a printed-circuit board 18 which is not illustrated, these polar zone 18a and 18b was taken about in three dimensions from the top face of a printed-circuit board 18 to the underside which is a component side, and is prolonged even to the ends of printed-circuit board 18 underside, respectively. The above-mentioned printed-circuit board 18 top and inside the resin frame 19, it fills up with the mould resin 134 which consists of an epoxy resin of the translucency which distributed the fluorescent substance so that the whole semi-conductor light emitting device 7b may be covered. Since the above-mentioned semi-conductor light emitting device 7b has Electrodes 6b and 5b to vertical both sides like the semi-conductor light emitting device of the conventional GaAs system or a GaP system, it has the advantage that it is common and the conventional leadframe can be used. In addition, as a base, the insulating film other than the above-mentioned printed-circuit board may be used.

[0136] The semi-conductor luminescence equipment of drawing 12 (b) is filled up with the mould resin 134 as closure resin which distributed the fluorescent substance while it is equipped with resin frame 19a on the printed circuit board 18 as a base and is equipped with semi-conductor light emitting device 7c which has an insulating substrate inside this resin frame 19a. The above-mentioned resin frame 19a inclines so that the side face facing semi-conductor light emitting device 7c may reflect the light by which outgoing radiation was carried out to the longitudinal direction from the side face of semi-conductor light emitting device 7c in the direction of a right angle of a printed circuit board 18.

[0137] This semi-conductor luminescence equipment is equipped with resin frame 19a toward which the side face which faces at semi-conductor light emitting device 7c on the printed circuit board 18 of the rectangular parallelepiped configuration which consists of glass epoxy inclined. The above-mentioned semi-conductor light emitting device 7c turns a semi-conductor laminating side face downward, and is carried in the printed-circuit board 18. P lateral electrode 6c and N lateral electrode 5c with which semi-conductor light emitting device 7c is equipped are respectively connected to the polar zone 18a and 18b on a printed-circuit board 18 through Au bump. The above-mentioned polar zone 18a and 18b is taken about in three dimensions to an underside like the semi-conductor luminescence equipment shown in drawing 12 (a) through the through hole which is not illustrated from the top face of a printed-circuit board 18, and is extended even to the underside ends of a printed-circuit board 18. In addition, as a base, the insulating film other than the above-mentioned printed-circuit board 18 may be used. Moreover, although direct continuation of the above-mentioned semi-conductor light emitting device 7c was carried out to the printed-circuit board 18, it may carry semi-conductor light emitting device 7c in submounting which gives metal wiring beforehand and consists of Si, and may connect this submounting to a printed-circuit board 18 electrically with die bond, wire bond, etc.

[0138] Since this semi-conductor luminescence equipment mounts the semi-conductor laminating side face of semi-conductor light emitting device 7c in the immediate printing wiring substrate 18, it has the advantage that the heat from the luminescence field of semi-conductor light emitting device 7c can be quickly missed to the exterior through submounting and a leadframe.

[0139] The mould resin 134 in the semi-conductor luminescence equipment of drawing 12 (a) and (b) is the same ingredient as the mould resin 13 of drawing 8 (a), (b), and (c), and distribution of the fluorescent substance in the above-mentioned mould resin can take various gestalten according to the class of mould resin, the class of fluorescent substance, an operating environment, conditions, an application, etc.

[0140] In drawing 12 (a) and (b), although the above-mentioned resin frames 19 and 19a were stuck on the printed-circuit board 18 after forming them apart from a printed-circuit board 18, they may remove some thicker printed-circuit boards, may form a crevice, and may use the surroundings of this crevice as a frame. Furthermore, while forming a through hole in a printed-circuit board, arranging an electrode-cum-wiring by the metallic foil on the base of this printed-circuit board and arranging a semi-conductor light emitting device after an electrode-cum-this wiring, the above-mentioned through hole part may be closed by closure resin.

[0141] Moreover, in the semi-conductor luminescence equipment of drawing 12 (a) and (b), semi-conductor light emitting device 7a shown in drawing 1 (a) is sufficient as the semi-conductor light emitting devices 7b and 7c, and when this semi-conductor light emitting device 7a is used, they connect the electrode of semi-conductor light emitting device 7a, and the polar zone of a printed-circuit board with a metal wire.

[0142] (6th operation gestalt) Drawing 13 is the sectional view showing the semi-conductor luminescence equipment in the 6th operation gestalt of this invention.

[0143] This semi-conductor luminescence equipment has the same frame 19a as the frame with which the semi-conductor luminescence equipment shown in drawing 12 (b) is equipped. This frame 19a is installed on the printed circuit board 18 as a base of the shape of a rectangular parallelepiped which consists of glass epoxy, and the side face facing semi-conductor light emitting device 7c of this frame 19a inclines so that the light from the side face of semi-conductor light emitting device 7c may be reflected in the direction of a right angle of a printed circuit board 18. The above-mentioned semi-conductor light emitting device 7c is carried on the printed-circuit board 18 so that outgoing radiation of the light may be carried out [in / for a semi-conductor laminating side / drawing 13] from an

upper substrate side towards the bottom in drawing 13 . The electrodes 6c and 5c of this semi-conductor light emitting device 7c are being connected to the polar zone 18a and 18b of a printed-circuit board 18 by the bump like the semi-conductor luminescence equipment shown in drawing 12 (b). It is filled up with the mould resin 135 as closure resin of the translucency which consists of an epoxy resin inside frame 19a arranged on the above-mentioned printed-circuit board 18, and the above-mentioned semi-conductor light emitting device 7c is closed. And on above-mentioned frame 19a and mould resin 13, a fluorescent substance 12 has predetermined thickness and is formed in the shape of a layer.

[0144] Since the fluorescent substance 12 is formed in the location of the abbreviation equal distance by the thickness of homogeneity from the luminescence field of semi-conductor light emitting device 7c, in the location of all the fluorescent substances 12, uniform luminescence which does not have nonuniformity by the quantity of light which passes a fluorescent substance 12 becoming abbreviation regularity is possible for the semi-conductor luminescence equipment in this operation gestalt. Moreover, since the above-mentioned fluorescent substance 12 keeps a predetermined distance and is formed from semi-conductor light emitting device 7c, it can ease the electric and thermal effect of a semi-conductor light emitting device to a fluorescent substance 12.

[0145] With the above-mentioned operation gestalt, although the fluorescent substance 12 was formed also in the top face of resin frame 19a, as long as resin frame 19a is formed with the ingredient of protection-from-light nature, it may form a fluorescent substance 12 in the upper chisel of mould resin 135. Moreover, the height of resin frame 19a is made high, after filling up extent slightly exceeding the upper bed of semi-conductor light emitting device 7c with mould resin 13, it is in the above-mentioned resin frame 19a, and a fluorescent substance may be arranged by potting etc. on the above-mentioned mould resin 135.

[0146] The above-mentioned resin frame 19a may use as a frame the heights which removed some thicker printed-circuit boards 18 like the time of describing the semi-conductor luminescence equipment of drawing 12 (b), and remained. Furthermore, an electrode-cum-wiring by the metallic foil may be prepared in the pars basilaris ossis occipitalis of a printed-circuit board which has a through hole, and a crevice may be formed in it.

[0147] Moreover, although the optical drawing effectiveness to the exterior falls, the resin frame in which the side face facing semi-conductor light emitting device 7c was formed vertically may be used.

[0148] In addition, the semi-conductor light emitting devices 7a and 7b shown in drawing 1 may be used for the above-mentioned semi-conductor light emitting device 7c. Especially semi-conductor light emitting device 7b that has a conductive substrate equips an upside and the bottom with an electrode, and since it is the same electrode structure as the semi-conductor light emitting device of the conventional GaAs system or a GaP system, it has the advantage that the conventional leadframe can be used as it is.

[0149] (7th operation gestalt) Drawing 14 (a) and (b) are the sectional views showing the semi-conductor luminescence equipment in the 7th operation gestalt of this invention.

[0150] Drawing 14 (a) is the sectional view which looked at this semi-conductor luminescence equipment from luminescence, and drawing 14 (b) is the sectional view seen from the right angle to the luminescence direction.

[0151] P lateral electrode 6a and N lateral electrode 5a which semi-conductor light emitting device 7a pasted up this semi-conductor luminescence equipment with the adhesives 11, such as an epoxy resin, on the printed-circuit board 18 as a base of the shape of a rectangular parallelepiped which consists of glass epoxy, and were prepared on the top face of this semi-conductor light emitting device 7a are respectively connected to the polar zone 18a and 18b of a printed-circuit board 18 by the metal wires 6p and 5n. These polar zone 18a and 18b was taken about in three dimensions on the underside of a printed-circuit board 18 through the through holes 19 and 19 of the shape of cross-section radii formed by penetrating a printed-circuit board 18, and is prolonged to the ends of the component side which is an underside of this printed-circuit board 18. In addition, it may change to the above-mentioned printed-circuit board 18, and an insulating film may be used.

[0152] Furthermore, the above-mentioned whole semi-conductor light emitting device 7a is closed with the mould resin 136 as closure resin which consists of an epoxy resin of the translucency which distributed the fluorescent substance. While this mould resin 136 has the abbreviation quadrant elliptical cross section where a left side edge and a bottom edge make a straight line in drawing 14 (b), it has the rectangle cross section where the cross direction is longer than the height direction in drawing 14 (a). And the reflector 20 for reflecting the light from above-mentioned semi-conductor light emitting device 7a on the above-mentioned mould resin 136 is formed.

[0153] As for the above-mentioned mould resin 136, it is desirable to use the thermosetting resin which has translucency and can also bear the elevated temperature in the case of a solder reflow in a mounting process, and it forms it by the resin potting method, the transfermold method, the injection molding method, etc. on a printed-circuit board 18. The top face of the above-mentioned mould resin 136 arranges semi-conductor light emitting device 7a more nearly up than center line I-I of this parabola while a parabola is made and it curves, as shown in drawing 14 (b). Moreover, the outgoing radiation side face A of the light of the above-mentioned mould resin 136 is formed evenly, and is made into the side face and abbreviation same side of a printed-circuit board 18. In addition, the curved surface of the above-mentioned mould resin 136 may be formed so that the above-mentioned semi-conductor light emitting device 7a may be caudad located rather than center line I-I of the parabola of a curved surface.

[0154] Including at least the ingredient which reflects the light by which wavelength conversion was carried out with the light and the fluorescent substance 12 of semi-conductor light emitting device 7a, like the above-mentioned mould resin 136, using the thermosetting resin or thermoplastics which can also bear the elevated temperature in the case of a solder reflow, the above-mentioned reflector 20 is formed by the resin potting method, the

transfermold method, the injection molding method, etc. so that the upside side of the above-mentioned mould resin 136 may be covered. The right side edge edge of a reflector 20 makes a straight line, and as shown in the cross section of drawing 14 (b), while the bottom edge curves in contact with the upside edge of mould resin 136, this reflector 20 is formed so that the right side edge side of the above-mentioned printed-circuit board 18 may be followed, so that the flat surface as the optical outgoing radiation side A of mould resin 136 where a left side edge edge is the same may be made. And the upper bed edge of the above-mentioned reflector is formed in parallel at the above-mentioned printed-circuit board 18. As for this semi-conductor luminescence equipment, the interface of the top face of mould resin 136 and the underside of a reflector 20 is a reflector. While diffusing the light which reflects and carries out outgoing radiation in this reflector on the left-hand side of horizontal in drawing 14 (a), it is interrupted with a reflector 20 and a printed-circuit board 18 in the vertical direction. Therefore, the direct light and the reflected light from semi-conductor light emitting device 7a serve as directional characteristics extracted horizontally. Specifically, the horizontal half power angle in exposure light has **65 degrees and the directional characteristics whose vertical half power angle is **30 degrees. therefore — since wavelength conversion is carried out with the fluorescent substance 12 in mould resin 136, it is reflected by the reflector 20 and outgoing radiation of it is carried out from the lateral portion of mould resin 136 to the exterior, while the light from semi-conductor light emitting device 7a carries out direct outgoing radiation — horizontal — an effective exposure field — large — and high — brightness side luminescence mold semi-conductor luminescence equipment can be offered.

[0155] In addition, since the reflector 20 should have reflex action only into the part which touches mould resin 136, it is good to prepare the reflecting layer which becomes either the upside side where mould resin 136 curved, or the bottom side as for which the reflector 20 carried out the bend from a metal, a white coating, etc.

[0156] The resin which pastes up the above-mentioned semi-conductor light emitting device 7a on a printed-circuit board 18 is [that there is especially no definition] available if the light from semi-conductor light emitting device 7a is not absorbed. For example, the resin which mixed the thermally conductive good metal for the heat-characteristic improvement of semi-conductor light emitting device 7a, the resin containing the ingredient which reflects and scatters efficiently the light emitted in the direction of the leadframe mounting section, etc. may be used. However, to use the resin containing a metal, it is necessary to take care that P lateral electrode and N lateral electrode do not short-circuit.

[0157] In addition, in the semi-conductor luminescence equipment in this operation gestalt, it may change to the above-mentioned semi-conductor light emitting device 7a, and semi-conductor light emitting device 7b which equips with an electrode the top face and underside which were shown in drawing 1 (b), respectively, and semi-conductor light emitting device 7c of the type which carries out outgoing radiation of the light from the substrate side shown in drawing 1 (c) may be used. Since the above-mentioned semi-conductor light emitting device 7b has the same electrode structure as the semi-conductor luminescence equipment of the conventional GaAs system or a GaP system, it has the advantage that the conventional leadframe can be used as it is. Since the above-mentioned semi-conductor light emitting device 7c mounts a semi-conductor laminating side face in direct electric wiring, it has the advantage that the heat from a luminescence field can be promptly missed to the exterior through a submounting leadframe.

[0158] (8th operation gestalt) Drawing 15 (a) and (b) are the sectional views showing the side luminescence mold semi-conductor luminescence equipment as 8th operation gestalt of this invention.

[0159] Drawing 15 (a) shows the sectional view which looked at this semi-conductor luminescence equipment from luminescence, and drawing 15 (b) is the sectional view seen from the right angle to the luminescence direction. The semi-conductor luminescence equipment of drawing 15 (a) and (b) used semi-conductor light emitting device 7b which has an electrode for the top face and the underside, Except having formed the fluorescent substance 12 in the outgoing radiation side A side of the light of the mould resin 137 as closure resin in the shape of a layer, without distributing a fluorescent substance in closure resin It is the same as that of the semi-conductor luminescence equipment of drawing 14 (a) and (b), and the same reference number is given to the part which has the same function, and detailed explanation is omitted.

[0160] The amount of the light which passes in the abbreviation whole region of a fluorescent substance 12 becomes always fixed [equipment], since this side luminescence mold semi-conductor luminescence equipment formed the fluorescent substance 12 in the location of the abbreviation equal distance from the luminescence field of semi-conductor light emitting device 7b at the thickness of homogeneity, and uniform luminescence without nonuniformity is attained. Moreover, since the fluorescent substance 12 has been arranged in the location estranged from semi-conductor light emitting device 7b, the effect by the current and heat of semi-conductor light emitting device 7b to a fluorescent substance 12 can be eased. Moreover, since the type which has arranged Electrodes 6b and 5b on the top face and the underside in the above-mentioned semi-conductor light emitting device 7b has same semi-conductor light emitting device and electrode structure of the conventional GaAs system or a GaP system, it has the advantage that the conventional leadframe can be used as it is.

[0161] In the operation gestalt of this invention, the above-mentioned semi-conductor light emitting device 7b may use semi-conductor light emitting device 7a of drawing 1 (a), and semi-conductor light emitting device 7c of drawing 1 (c).

[0162] (9th operation gestalt) Drawing 16 (a) and (b) are drawings showing the side luminescence mold semi-conductor luminescence equipment which is the 9th operation gestalt of this invention.

[0163] Drawing 16 (a) is the sectional view which looked at this semi-conductor luminescence equipment from luminescence, and (b) is the sectional view seen from the right angle to the luminescence direction. This semi-

conductor luminescence equipment is equipped with the mould resin 139 as closure resin which closes semi-conductor light emitting device 7c on the printed-circuit board 18 as a base. This mould resin 139 has the left-hand side of an ellipse, and an abbreviation quadrant elliptical cross section where the lower part was removed and which is a configuration in drawing 16 (b) while having an abbreviation half elliptical cross section where the lower half of an ellipse was removed in drawing 16 (a) and which is a configuration. That is, the above-mentioned mould resin 139 makes the shape of dome shape in which the field except the optical outgoing radiation side A has predetermined radius of curvature in a printed-circuit board 18 top. And the curved-surface part of the lateral surface of this mould resin 139 is covered, fluorescent substance layer 12a as a fluorescent substance is formed, and the reflector 20 for reflecting the light from semi-conductor light emitting device 7c in that lateral surface further is formed.

[0164] Furthermore, the obstruction object 21 as a screen intercepted so that light from semi-conductor light emitting device 7c may not be directly taken out to the exterior is formed in the optical outgoing radiation side A side of semi-conductor light emitting device 7c on a printed-circuit board 18. This obstruction object 21 is seen from the luminescence side A side of semi-conductor luminescence equipment 94 (refer to drawing 16 (a)), it has the height and width of face which interrupt the luminescence field of semi-conductor light emitting device 7c, and an opaque resin metallurgy group etc. is used to the light of semi-conductor light emitting device 7c. Moreover, although the ingredient which absorbs light as an ingredient of the obstruction object 21 may be used, the utilization effectiveness of light worsens in that case. Moreover, as a broken line shows, obstruction object 21a which consists of a resin frame surrounding the surroundings of semi-conductor light emitting device 7c may be used for drawing 16 (b). Moreover, in order to interrupt the light by which direct outgoing radiation is carried out from above-mentioned semi-conductor light emitting device 7c, a crevice may be formed in some thicker printed-circuit boards, and a semi-conductor light emitting device may be arranged so that a luminescence field may hide in this crevice. Since the luminescence field of a semi-conductor light emitting device is located caudad, it can make the height of an obstruction object low, and its utilization effectiveness of light is large while it can miss the heat from a luminescence field quickly to the exterior through a submounting leadframe, since semi-conductor light emitting device 7c connects and carries a semi-conductor laminating side in the immediate printing wiring substrate 18. In addition, it is also possible to use for the semi-conductor luminescence equipment of the 7th operation gestalt which showed above-mentioned Screens 21 and 21a and an above-mentioned crevice to drawing 14 (a) and (b).

[0165] It is reflected by the reflector 20 which touches this fluorescent substance layer 12a after wavelength conversion is carried out by the above-mentioned fluorescent substance layer 12a, and after wavelength conversion is again carried out by fluorescent substance layer 12a, outgoing radiation of the outgoing radiation light from above-mentioned semi-conductor light emitting device 7c is carried out to the semi-conductor luminescence equipment exterior. Therefore, compared with semi-conductor luminescence equipment equipped with the fluorescent substance arranged in the direction of outgoing radiation of light so that the light from a semi-conductor light emitting device may only penetrate, as for this semi-conductor luminescence equipment, it has the wavelength conversion efficiency of abbreviation two times. Therefore, since sufficient wavelength conversion effectiveness is expectable even if it makes fluorescent substance layer 12a thin, the amount of the fluorescent substance used can be reduced and the cost of semi-conductor luminescence equipment can be reduced.

[0166] Although fluorescent substance layer 12a in the above-mentioned operation gestalt made light penetrate and wavelength conversion was performed, it is nontransparent and the fluorescent substance reflected while carrying out wavelength conversion of the light may be formed as a reflector. For example, the fluorescent substance which applied the fluorescence ingredient to the front face with the property to reflect and scatter light of a very fine particle can be considered.

[0167] In addition, in this operation gestalt, the semi-conductor light emitting devices 7a and 7b which change to semi-conductor light emitting device 7c, and are shown in drawing 1 (a) and (b) may be used. Since especially the semi-conductor light emitting device 7 (b) that has a conductive substrate has the same electrode structure as the semi-conductor light emitting device of the conventional GaAs system which has an electrode in a vertical both-sides side, or a GaP system, it can use the conventional leadframe as it is.

[0168] (10th operation gestalt) Drawing 17 (a) and (b) are the sectional views showing the side luminescence mold semi-conductor luminescence equipment as 10th operation gestalt of this invention.

[0169] Drawing 17 (a) shows the sectional view which looked at the above-mentioned semi-conductor luminescence equipment from luminescence, and drawing 17 (b) is the sectional view seen from the right angle to the luminescence direction. The point that this operation gestalt differs from the 9th operation gestalt shown in drawing 16 (a) and (b) The point using semi-conductor light emitting device 7b which changes to semi-conductor light emitting device 7c, and has a conductive substrate, It is a point using printed-circuit board 18a as a base which comes to equip the ultra-thin mold printed-circuit board 23 which changed to the printed-circuit board 18, became the base of the glass epoxy group plate which has a through hole B from the metallic foil, and was equipped with an electrode-cum-wiring.

[0170] As shown in drawing 17 (a) and (b), this side luminescence mold semi-conductor luminescence equipment is installed on the above-mentioned ultra-thin printed-circuit board 23 so that semi-conductor light emitting device 7b may be hidden in the breakthrough B of printed-circuit board 18a. Therefore, since the luminescence field of semi-conductor light emitting device 7b hides thoroughly from the outside while thin shape-ization of semi-conductor luminescence equipment is attained, since the height of semi-conductor light emitting device 7b is absorbable by the thickness of printed-circuit board 18a, the light by which outgoing radiation is carried out does not come out of semi-conductor light emitting device 7b outside directly. That is, since outgoing radiation only of the light from

which wavelength was changed by fluorescent substance layer 12a as a fluorescent substance is carried out to the exterior of semi-conductor luminescence equipment, the color tone of semi-conductor luminescence equipment becomes still better. In addition, the depth of the above-mentioned breakthrough B should just be extent in which the luminescence field of semi-conductor light emitting device 7b sees and hides from the outgoing radiation side A (refer to drawing 17 (b)) side of light at least.

[0171] In addition, in the above-mentioned operation gestalt, the semi-conductor light emitting devices 7a and 7c shown in drawing 1 (a) and (c) may be used for semi-conductor light emitting device 7b. Since a luminescence field is located near the pars basilaris ossis occipitalis of a through hole B when it has arranged in Breakthrough B, semi-conductor luminescence equipment is further made especially as for the above-mentioned semi-conductor light emitting device 7c to a thin shape.

[0172] (11th operation gestalt) Drawing 18 (a), (b), (c) and drawing 19 (a), (b), and (c) are drawings having shown the wavelength distribution of light in which the semi-conductor luminescence equipment of the 11th operation gestalt of this invention carries out outgoing radiation. This semi-conductor luminescence equipment is equipped with a semi-conductor light emitting device on a base, and the outgoing radiation light of this semi-conductor light emitting device has the peak of luminescence wavelength in 410nm of a wavelength field (390nm thru/or 420nm). Furthermore, this semi-conductor luminescence equipment is equipped with the 1st, 2nd, and 3rd fluorescent substance which changes the outgoing radiation light of the above-mentioned semi-conductor light emitting device. The above-mentioned semi-conductor light emitting device is closed by the closure resin which consists of resin which is not damaged by this semi-conductor light emitting device, and after the 1st, 2nd, and 3rd fluorescent substance of the above has been mixed by abbreviation homogeneity, it is contained in this closure resin. The 1st fluorescent substance of the above consists of a fluorescent substance of 0.5MgF2 and 3.5 MgO-GeO2:Mn, it is excited by the outgoing radiation light of the above-mentioned semi-conductor light emitting device, and luminescence wavelength carries out outgoing radiation of the red light which has the main peak in 658nm. The 2nd fluorescent substance of the above consists of a fluorescent substance of SrAl2O4:Eu, and luminescence wavelength carries out outgoing radiation of the green light which has the main peak in 522nm. The 3rd fluorescent substance of the above consists of a fluorescent substance of BaMgAl10O17:Eu, and luminescence wavelength carries out outgoing radiation of the blue light which has the main peak in 452nm. By carrying out color mixture of the outgoing radiation light from the 1st, 2nd, and 3rd fluorescent substance of the above, this semi-conductor luminescence equipment carries out outgoing radiation of the white light, and is used as the light source for back lights of indicating equipments, such as a cellular phone, and a Personal Digital Assistant, a personal computer. In addition, although it is in a wavelength field (390nm thru/or 420nm), if the peak of the luminescence wavelength of the above-mentioned semi-conductor light emitting device is in a wavelength field (400nm thru/or 420nm), it is more desirable.

[0173] In the above-mentioned semi-conductor luminescence equipment, drawing 18 (a), (b), and (c) are drawings having shown change produced in wavelength distribution of outgoing radiation light, when the mixed ratio of the 1st, 2nd, and 3rd fluorescent substance of the above is changed. An axis of abscissa is wavelength (nm) and all of an axis of ordinate are relative intensity (%). Moreover, also in any, the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance of the above to the weight of the above-mentioned closure resin is 0.5.

[0174] Drawing 18 (a) is drawing in which the 1st fluorescent substance showed wavelength distribution of the outgoing radiation light by semi-conductor luminescence equipment in case 47 % of the weight and the 2nd fluorescent substance are [13 % of the weight and the 3rd fluorescent substance] 40 % of the weight noting that the total amount of the 1st, 2nd, and 3rd fluorescent substance is 100 % of the weight. The outgoing radiation light of the semi-conductor luminescence equipment in this case becomes the white of the color tone which green cut a little.

[0175] Drawing 18 (b) is drawing in which the 1st fluorescent substance showed wavelength distribution of the outgoing radiation light by semi-conductor luminescence equipment in case 56 % of the weight and the 2nd fluorescent substance are [11 % of the weight and the 3rd fluorescent substance] 33 % of the weight noting that the total amount of the 1st, 2nd, and 3rd fluorescent substance is 100 % of the weight. The outgoing radiation light of the semi-conductor luminescence equipment in this case becomes the white of a good color tone.

[0176] Drawing 18 (c) is drawing in which the 1st fluorescent substance showed wavelength distribution of the outgoing radiation light by semi-conductor luminescence equipment in case 65 % of the weight and the 2nd fluorescent substance are [26 % of the weight and the 3rd fluorescent substance] 9 % of the weight noting that the total amount of the 1st, 2nd, and 3rd fluorescent substance is 100 % of the weight. The outgoing radiation light of the semi-conductor luminescence equipment in this case becomes the white of the color tone which red cut a little, and the so-called daytime white.

[0177] moreover, La2O2 S:Eu as the 1st fluorescent substance and BaMg2aluminum16O27: as the 2nd fluorescent substance — the semi-conductor luminescence equipment equipped with Eu, Mn, and 10(Sr, calcium, Mg, Ce) (PO4) 6Cl2:Eu as the 3rd fluorescent substance in order at 72 % of the weight, 7 % of the weight, and 21% of the weight of a rate was formed. The outgoing radiation light of this semi-conductor luminescence equipment was the good white light. Furthermore, a white outgoing radiation light also with the good semi-conductor luminescence equipment equipped with the 1st, 2nd, and 3rd fluorescent substance of the above in order at 58 % of the weight, 22 % of the weight, and 20% of the weight of a rate was obtained. While becoming the white of the color tone which green cut when the above experimental result was taken into consideration, and the luminescent color of the above-mentioned semi-conductor luminescence equipment had few mixed ratios of the 1st fluorescent substance, i.e., the

fluorescent substance of red luminescence, than 50 % of the weight, when there were more mixed ratios of the 1st fluorescent substance of the above than 70 % of the weight, it turned out that it becomes the white of the color tone which red cut. Moreover, it turned out that the luminescent color of the above-mentioned semi-conductor luminescence equipment turns into white of the color tone which red cut when there were few mixed ratios of the 2nd fluorescent substance, i.e., the fluorescent substance of green luminescence, than 7 % of the weight, and it will become the white of the color tone which green cut if there are more mixed ratios of the 2nd fluorescent substance of the above than 20 % of the weight. Moreover, it turned out that the luminescent color of the above-mentioned semi-conductor luminescence equipment turns into white of the color tone which red cut when there were few mixed ratios of the 3rd fluorescent substance, i.e., the fluorescent substance of blue luminescence, than 20 % of the weight, and it will become the white of the color tone which green cut if there are more mixed ratios of the 3rd fluorescent substance of the above than 30 % of the weight. therefore, the case where the ratio of the AUW of the 1st [as opposed to the weight of closure resin in the semi-conductor luminescence equipment of the 11th operation gestalt] thru/or the 3rd fluorescent substance is 0.5 — the 1st, 2nd, and 3rd fluorescent substance — 56 % of the weight of each, 11 % of the weight, and 33% of the weight of a mixing ratio — a good white outgoing radiation light is obtained with it being a rate.

[0178] In the above-mentioned semi-conductor luminescence equipment, drawing 19 (a), (b), and (c) are drawings having shown change produced in wavelength distribution of outgoing radiation light, when the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance to the weight of closure resin is changed. An axis of abscissa is wavelength (nm) and all of an axis of ordinate are relative intensity (%). Moreover, also in any, for the 1st fluorescent substance, the 2nd fluorescent substance is [the 3rd fluorescent substance] 9% of the weight of a mixed ratio 26% of the weight 65% of the weight noting that the total amount of the 1st, 2nd, and 3rd fluorescent substance is 100 % of the weight.

[0179] Drawing 19 (a) is drawing having shown wavelength distribution of the outgoing radiation light by semi-conductor luminescence equipment in case the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance to the weight of closure resin is 0.5. The outgoing radiation light of this semi-conductor luminescence equipment becomes the white of the color tone which red cut a little, and the so-called daytime white.

[0180] Drawing 19 (b) is drawing having shown wavelength distribution of the outgoing radiation light by semi-conductor luminescence equipment in case the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance to the weight of closure resin is 0.66. The outgoing radiation light of this semi-conductor luminescence equipment becomes the white of a good color tone.

[0181] Drawing 19 (c) is drawing having shown wavelength distribution of the outgoing radiation light by semi-conductor luminescence equipment in case the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance to the weight of closure resin is 1.0. The outgoing radiation light of this semi-conductor luminescence equipment becomes the white of the color tone which green cut a little.

[0182] Drawing 19 (a), (b), and (c) show that a white outgoing radiation light of a color tone with the above-mentioned semi-conductor luminescence equipment good when the 1st, 2nd, and 3rd fluorescent substance of the above is 65 % of the weight, 26 % of the weight, and 9 % of the weight respectively and the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance to the weight of closure resin is 1.0 or less [0.5 or more] is obtained.

[0183] Drawing 20 is drawing showing the emission spectrum 150 of the semi-conductor luminescence equipment shown in drawing 19 (a), and the effective emission spectrum 152 of the semi-conductor luminescence equipment in consideration of human being's relative luminous efficiency 151. An axis of abscissa is wavelength (nm) and an axis of ordinate is relative intensity (%).

[0184] Since it has a larger luminescence wavelength field than the wavelength field which human being's relative luminous efficiency 151 has and the effective emission spectrum 152 of the wavelength field which covers the wavelength field of the above-mentioned relative luminous efficiency 151 is obtained, in human being's vision, a color tone is made as for the emission spectrum 150 of the above-mentioned semi-conductor luminescence equipment to the good white luminescent color, so that drawing 20 may show.

[0185] Furthermore, since the above-mentioned semi-conductor luminescence equipment is resin which the above-mentioned closure resin does not damage by the outgoing radiation light from a semi-conductor light emitting device, inconvenience, such as melanism, does not produce this closure resin. Therefore, inconvenience, such as lowering of the brightness of semi-conductor luminescence equipment, can be prevented, it continues at a long period of time, and the engine performance of semi-conductor luminescence equipment is made to stability.

[0186] In the above-mentioned semi-conductor luminescence equipment, the wavelength field range of human being's relative luminous efficiency 151, abbreviation, etc. may spread and carry out the wavelength field of the above-mentioned effective emission spectrum 152 by using two or more fluorescent substances of a class for the 1st, 2nd, and 3rd fluorescent substance of the above respectively. Since the luminescence wavelength field of semi-conductor luminescence equipment is made by this only in human being's visible region while being able to make good the color tone of the luminescent color of semi-conductor luminescence equipment, the luminous efficiency of semi-conductor luminescence equipment can be improved.

[0187] Although the semi-conductor luminescence equipment of this operation gestalt mixed the 1st, 2nd, and 3rd fluorescent substance of the above at abbreviation homogeneity to the closure resin which closes a semi-conductor light emitting device Only the 1st, 2nd, and 3rd fluorescent substance of the above may be mixed, and this mixed fluorescent substance may be arranged in the shape of a layer on the front face of closure resin, and the 1st, 2nd, and 3rd fluorescent substance of the above may be respectively prepared in the front face of the above-mentioned

closure resin in the shape of a layer separately. In this case, it is desirable to arrange in consideration of luminescence / absorption wavelength of light etc. toward a side far from the side near a semi-conductor light emitting device in order with the short luminescence wavelength of the fluorescent substance with which that layer contains each layer. Moreover, the semiconductor device of this operation gestalt may be formed in the same structure as the semi-conductor luminescence equipment of the above 1st thru/or the operation gestalt of 10. By this, white luminescence of a good color tone can be obtained in the semi-conductor luminescence equipment of a ramp type, a chip mold, and a side luminescence mold.

[0188] (12th operation gestalt) Drawing 21 is the mimetic diagram showing the luminescence display of the 12th operation gestalt of this invention. This luminescence display 200 is a liquid crystal display which has the light source 201 which consists of semi-conductor luminescence equipment of the operation gestalt of the above 11th, the light guide plate 202 to which the light 205 from the light source 201 is led, and the liquid crystal panel 203 equipped with the light filter which carries out the spectrum of the light from this light guide plate 202.

[0189] The above-mentioned light source 201 may be formed using any of the semi-conductor luminescence equipment of the above 1st thru/or the operation gestalt of 11. Especially when the above-mentioned luminescence display 200 is used as displays, such as a cellular phone, and a Personal Digital Assistant, a personal computer, the semi-conductor luminescence equipment of white luminescence of the operation gestalt of the above 11th is suitable as the light source 201. Moreover, if the 1st, 2nd, and 3rd fluorescent substance with which the semi-conductor luminescence equipment of the operation gestalt of the above 11th is equipped is used as a fluorescent substance of the semi-conductor luminescence equipment of the above 4th thru/or the operation gestalt of 6, it will have a chip part shape and the semi-conductor luminescence equipment for which light can be emitted white will be obtained. Since this semi-conductor luminescence equipment has a chip part shape, the handling at the time of mounting in the luminescence display 200 becomes easy. Moreover, since the semi-conductor luminescence equipment which has the above-mentioned chip part shape can be attached to side-face 202a of the above-mentioned light guide plate 202 direct picking, it can lead luminescence light to a light guide plate 202 efficiently. Moreover, if the light source 201 is constituted using the semi-conductor luminescence equipment carrying the fluorescent substance of the 11th operation gestalt to the semi-conductor luminescence equipment of the above 7th thru/or the operation gestalt of 10 Since this semi-conductor luminescence equipment is a side luminescence mold, so that the printed-circuit board 18 as a base may turn into a light guide plate 202 to abbreviation parallel By attaching semi-conductor luminescence equipment in side-face 202a of a light guide plate, thickness of the luminescence display 200 of the direction of optical outgoing radiation of this light guide plate 202 can be effectively made small. In addition, although two or more semi-conductor luminescence equipments were used for it, as long as the above-mentioned light source 201 has enough luminous intensity, one semi-conductor luminescence equipment may constitute it.

[0190] The above-mentioned light guide plate 202 is formed from a polycarbonate, acrylic resin, etc. Moreover, if the light reflex section is prepared in fields other than side-face 202a into which the light from the light source 201 is introduced, and light emission side 202b which emits the introduced light, the light from the light source 201 can be efficiently emitted from light emission side 202b. Moreover, you may introduce from two side faces which the light to a light guide plate 202 is not only from one side-face 202a, for example, counter, or may introduce from three and four side faces. Furthermore, in order to make bleedoff luminous intensity in light emission side 202b into homogeneity, a light-scattering agent may be mixed into a light guide plate 202, or the field by the side of the bottom in the above-mentioned light emission side 202b and drawing 21 which counters may be made to incline, the light introduced from side-face 202a of a light guide plate may be reflected on the above-mentioned bottom side face in which dip was carried out, and you may emit from light emission side 202b. If a light-scattering pattern is prepared in the above-mentioned bottom side face, reinforcement of the light 206 from light emission side 202b will be further made to homogeneity.

[0191] The above-mentioned liquid crystal panel 203 is equipped with the light filter stuck on the liquid crystal enclosed between two transparent substrates which prepared the transparent electrode, and these two substrates, the polarizing plate, and the above-mentioned substrate. Corresponding to two or more pixels by which the quantity of light which penetrates the above-mentioned liquid crystal is adjusted, red and a green and blue light filter are formed in the above-mentioned light filter by the signal impressed to the above-mentioned transparent electrode. It is a color or a pigment of light transmission nature etc., and it is colored red, green, and blue and red and a green and blue light filter are formed so that this light filter may make the pixel of a minute honeycomb configuration or a delta array configuration to a polycarbonate, polyethylene terephthalate, etc. which were formed in the shape of a sheet.

[0192] Drawing 22 is drawing having shown the spectral characteristic of the above-mentioned light filter, 210 is the spectral characteristic of a red light filter, and 212 is [211 is the spectral characteristic of a green light filter, and] the spectral characteristic of a blue light filter. Wavelength distribution of the light from the above-mentioned light source 201 is adjusted so that the spectral characteristic 210,211,212 of this light filter may be suited. In more detail, in the semi-conductor luminescence equipment which constitutes the light source 201, the luminescence wavelength of a semi-conductor light emitting device, the luminescence wavelength of the 1st, 2nd, and 2nd fluorescent substance and a mixed ratio, the rate of a compounding ratio of the AUW of the fluorescent substance of the 1st thru/or 3 and the weight of the resin for closure, etc. are adjusted, and wavelength distribution of the light 205 from the light source 201 is fitted to the spectral characteristic 210,211,212 of the above-mentioned light filter. For example, the semi-conductor luminescence equipment which has a good color tone and makes wavelength

distribution of drawing 19 (b) conforms to the spectral characteristic of drawing 22 . This semi-conductor luminescence equipment is because the above 1st thru/or the rate of a compounding ratio of the AUW of the fluorescent substance of 3 and the weight of the resin for closure are adjusted so that the above-mentioned spectral characteristic may be suited. Thus, since the above-mentioned light source 201 has the wavelength distribution which suits the spectral characteristic of the above-mentioned light filter, if the light 205 from this light source 201 is led to a liquid crystal panel 203 through the above-mentioned light guide plate 202, with the light filter of this liquid crystal panel 203, its brightness will be high and a spectrum will be carried out to the red of an abbreviation single, and the green and blue light 207. Consequently, a deer with a color tone good [this luminescence display 200] can also display the image and image of high brightness and high contrast.
[0193]

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing 1 (a), (b), and (c) are sectional views of a semi-conductor light emitting device used in this invention.

[Drawing 2] Drawing 2 (a) is drawing showing the emission spectrum of a fluorescent substance about the red luminescent color, and drawing 2 (b) is drawing showing the excitation spectrum of a fluorescent substance.

[Drawing 3] Drawing 3 (a) is drawing showing the emission spectrum of a different fluorescent substance from drawing 2 about the red luminescent color, and drawing 3 (b) is drawing showing the excitation spectrum of a fluorescent substance.

[Drawing 4] Drawing 4 (a) is drawing showing the emission spectrum of a fluorescent substance about the green luminescent color, and drawing 4 (b) is drawing showing the excitation spectrum of a fluorescent substance.

[Drawing 5] Drawing 5 (a) is drawing showing the emission spectrum of a different fluorescent substance from drawing 4 about the green luminescent color, and drawing 5 (b) is drawing showing the excitation spectrum of a fluorescent substance.

[Drawing 6] Drawing 6 (a) is drawing showing the emission spectrum of a fluorescent substance about the blue luminescent color, and drawing 6 (b) is drawing showing the excitation spectrum of a fluorescent substance.

[Drawing 7] Drawing 7 (a) is drawing showing the emission spectrum of a different fluorescent substance from drawing 6 about the blue luminescent color, and drawing 7 (b) is drawing showing the excitation spectrum of a fluorescent substance.

[Drawing 8] Drawing 8 (a), (b), and (c) are the sectional views showing the semi-conductor luminescence equipment in the 1st operation gestalt of this invention.

[Drawing 9] Drawing 9 (a) and (b) are the sectional views showing the semi-conductor luminescence equipment in the 2nd operation gestalt of this invention.

[Drawing 10] Drawing 10 (a) and (b) are the sectional views showing the semi-conductor luminescence equipment in the 3rd operation gestalt of this invention.

[Drawing 11] Drawing 11 (a) and (b) are the sectional views showing the semi-conductor luminescence equipment in the 4th operation gestalt of this invention.

[Drawing 12] Drawing 12 (a) and (b) are the sectional views showing the semi-conductor luminescence equipment in the 5th operation gestalt of this invention.

[Drawing 13] It is the sectional view showing the semi-conductor luminescence equipment in the 6th operation gestalt of this invention.

[Drawing 14] Drawing 14 (a) is the sectional view seen from the transverse plane of the semi-conductor luminescence equipment in the 7th operation gestalt of this invention, and drawing 14 (b) is the sectional view seen from the side face.

[Drawing 15] Drawing 15 (a) is the sectional view seen from the transverse plane of the semi-conductor luminescence equipment in the 8th operation gestalt of this invention, and drawing 15 (b) is the sectional view seen from the side face.

[Drawing 16] Drawing 16 (a) is the sectional view seen from the transverse plane of the semi-conductor luminescence equipment in the 9th operation gestalt of this invention, and drawing 16 (b) is the sectional view seen from the side face.

[Drawing 17] Drawing 17 (a) is the sectional view seen from the transverse plane of the semi-conductor luminescence equipment in the 10th operation gestalt of this invention, and drawing 17 (b) is the sectional view seen from the side face.

[Drawing 18] When the 1st fluorescent substance is [the 3rd fluorescent substance] 40 % of the weight, the 2nd fluorescent substance drawing 18 (a) 13% of the weight 47% of the weight drawing 18 (b) When 56 % of the weight and the 2nd fluorescent substance are [11 % of the weight and the 3rd fluorescent substance] 33 % of the weight for the 1st fluorescent substance, drawing 18 (c) is drawing in which the 1st fluorescent substance showed wavelength distribution of the outgoing radiation light of semi-conductor luminescence equipment in case 65 % of the weight and the 2nd fluorescent substance are [26 % of the weight and the 3rd fluorescent substance] 9 % of the weight.

[Drawing 19] Drawing 19 (a) is drawing having shown wavelength distribution of the outgoing radiation light of semi-conductor luminescence equipment in case drawing 19 (c) is 1.0, when the ratio of the AUW of the 1st, 2nd, and 3rd fluorescent substance to the weight of closure resin is 0.5, and drawing 19 (b) is 0.66.

[Drawing 20] It is drawing showing the emission spectrum 150 of the semi-conductor luminescence equipment shown in drawing 19 (a), and the effective emission spectrum 152 of the semi-conductor luminescence equipment in consideration of human being's relative luminous efficiency 151.
[Drawing 21] It is the mimetic diagram showing the luminescence display of the 12th operation gestalt of this invention.
[Drawing 22] It is drawing having shown the spectral characteristic of the light filter with which the luminescence display of this invention is equipped.
[Description of Notations]
7a Semi-conductor light emitting device
7b Semi-conductor light emitting device
7c Semi-conductor light emitting device
10 Leadframe
12 Fluorescent Substance

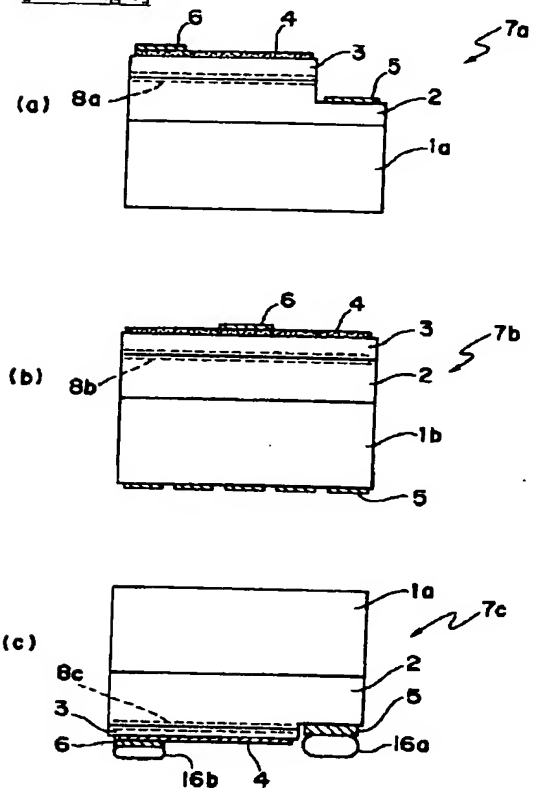
[Translation done.]

* NOTICES *

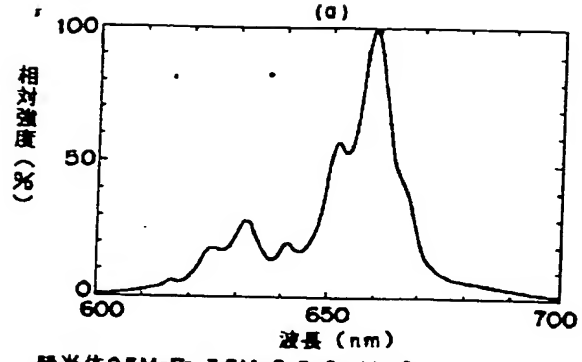
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

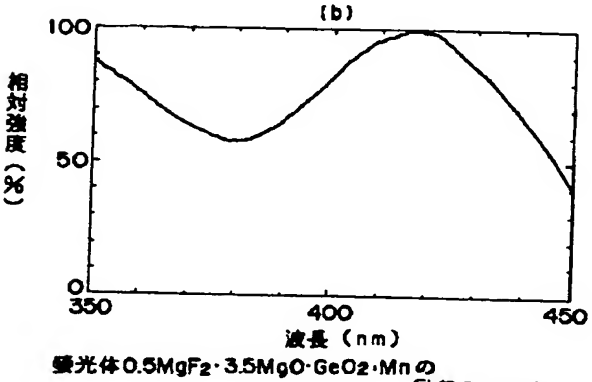
[Drawing 1]



[Drawing 2]

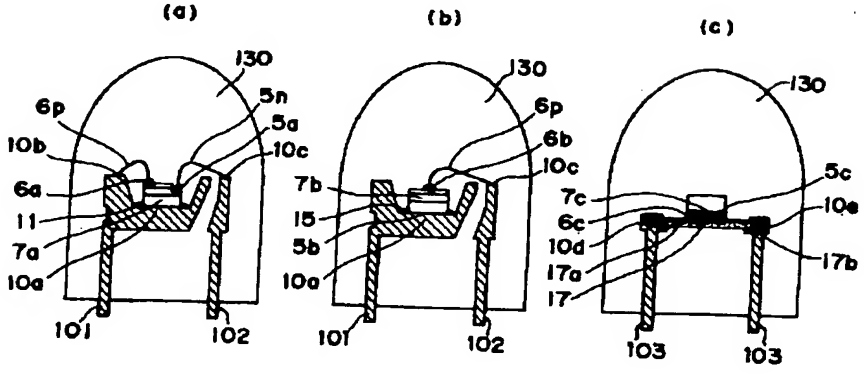


蛍光体0.5MgF2·3.5MgO·GeO2:Mnの
発光スペクトル

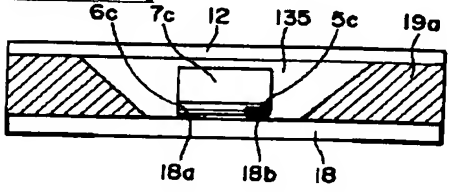


蛍光体0.5MgF2·3.5MgO·GeO2:Mnの
励起スペクトル

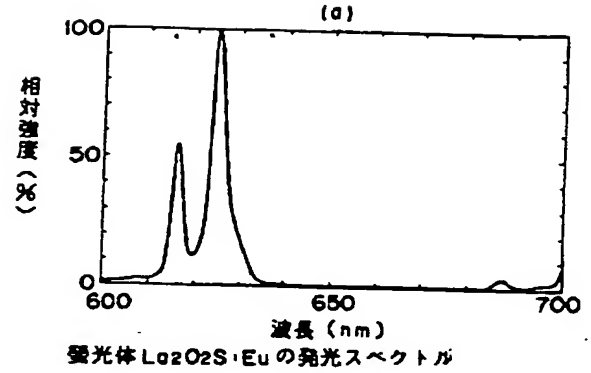
[Drawing 8]



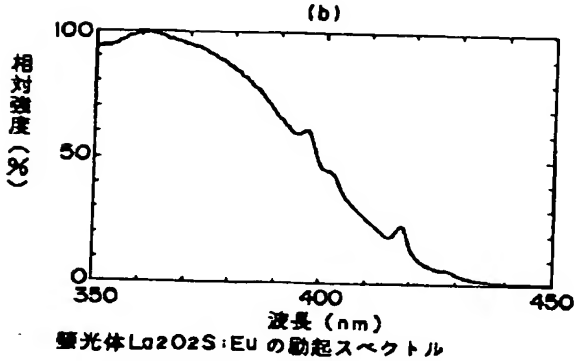
[Drawing 13]



[Drawing 3]

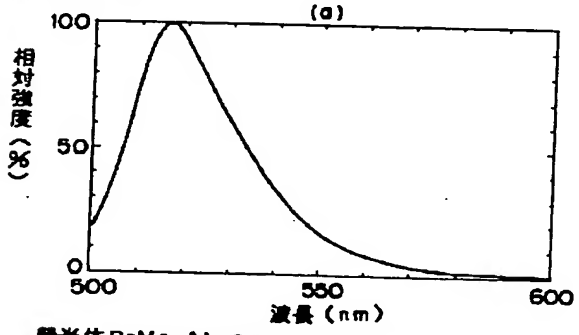


蛍光体La2O2S:Euの発光スペクトル

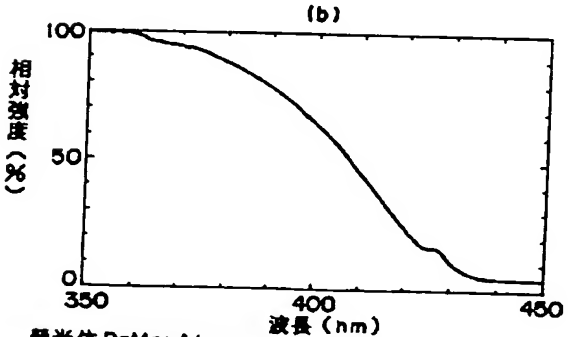


蛍光体La2O2S:Euの励起スペクトル

[Drawing 4]



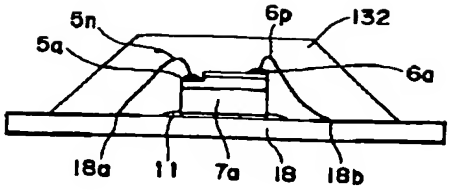
蛍光体BaMg2Al16O27:Eu,Mnの発光スペクトル



蛍光体BaMg2Al16O27:Eu,Mnの励起スペクトル

[Drawing 11]

(a)



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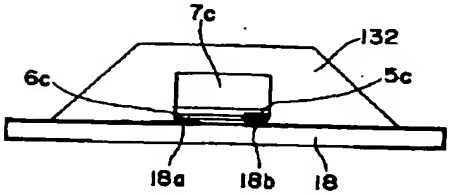
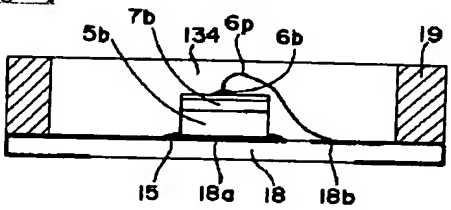


[Drawing 12]

(a)



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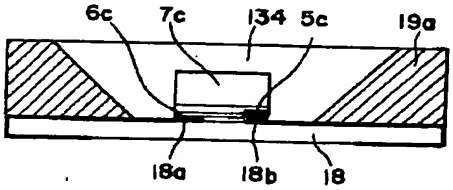

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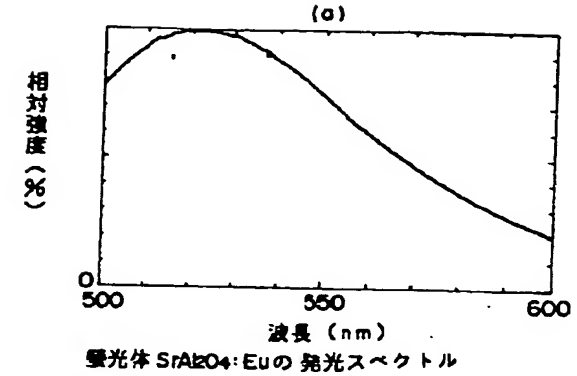
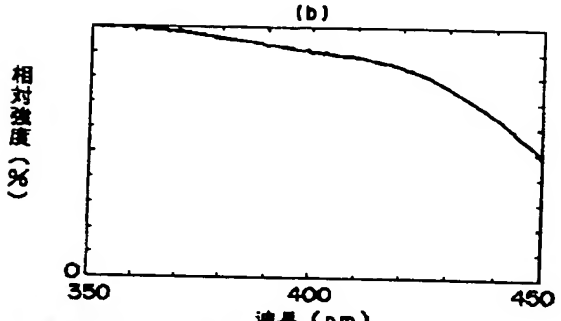
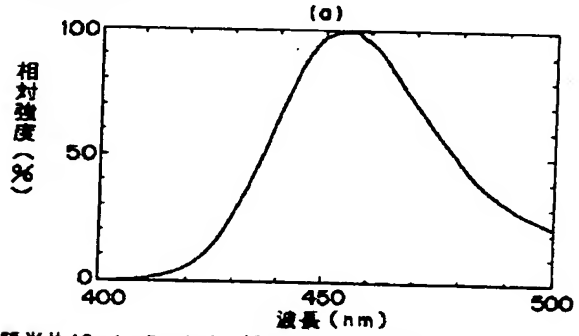


蛍光体 $SrAl_2O_4$:Euの発光スペクトル

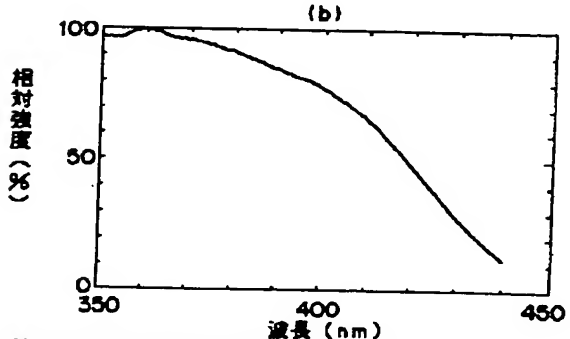


蛍光体 $SrAl_2O_4$:Euの励起スペクトル

[Drawing 6]

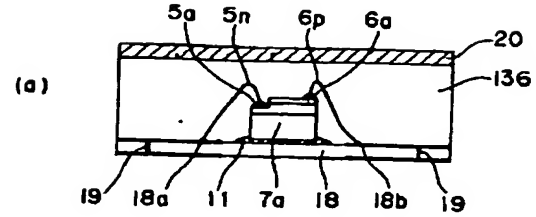


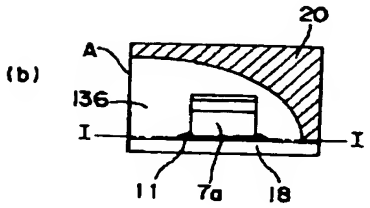
蛍光体 $(Sr,Ca,Ba,Ce)_{10}(PO_4)_6Cl_2$:Euの発光スペクトル



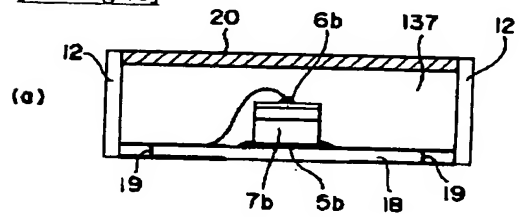
蛍光体 $(Sr,Ca,Ba,Ce)_{10}(PO_4)_6Cl_2$:Euの励起スペクトル

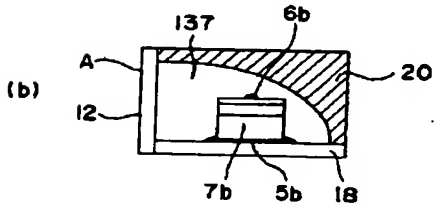
[Drawing 14]



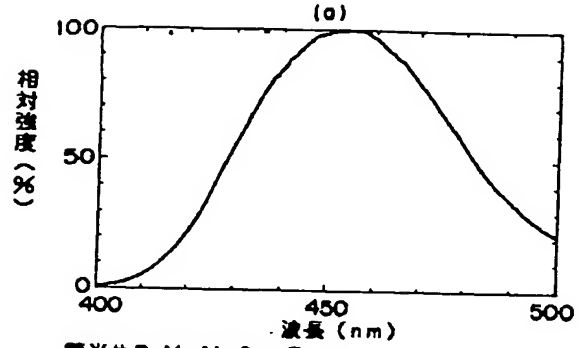


[Drawing 15]

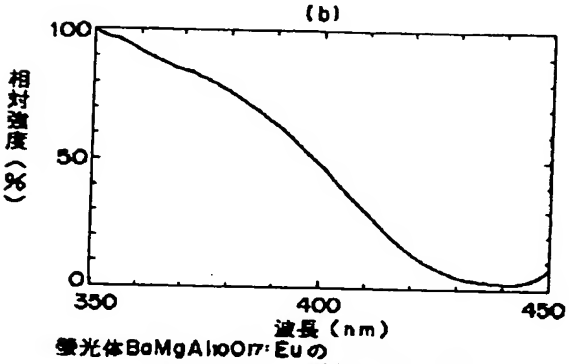




[Drawing 7]

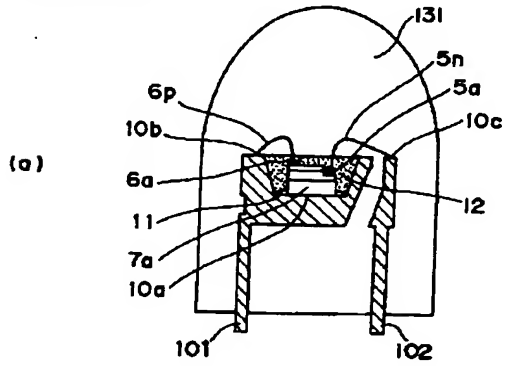


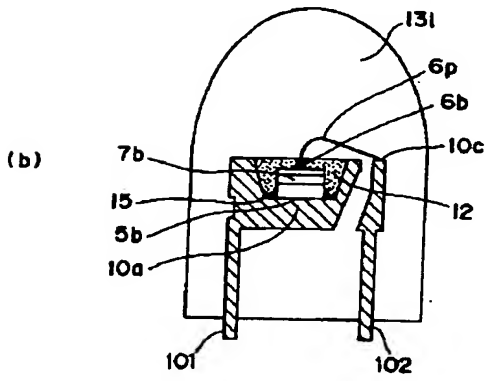
蛍光体BaMgAl10O17:Euの
発光スペクトル



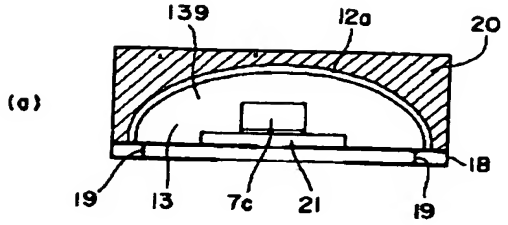
蛍光体BaMgAl10O17:Euの
励起スペクトル

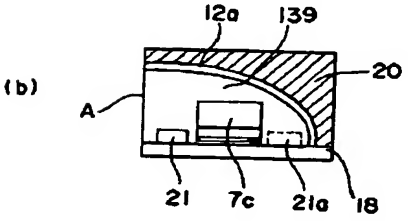
[Drawing 9]



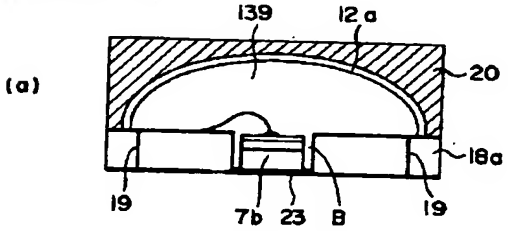


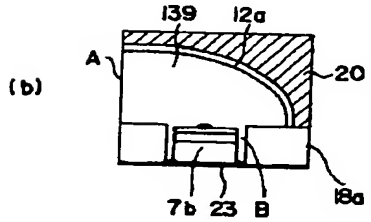
[Drawing 16]





[Drawing 17]





[Drawing 10]

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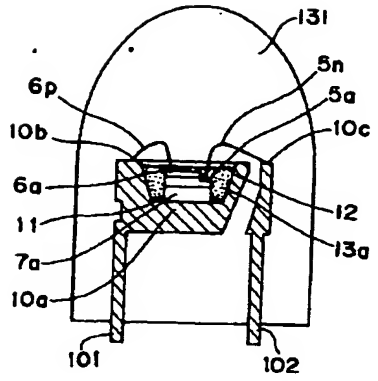

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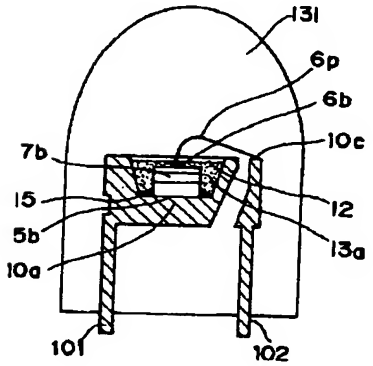
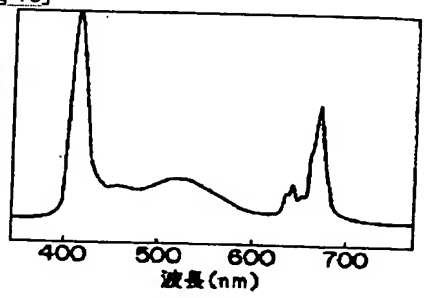


[Drawing 18]

(a)



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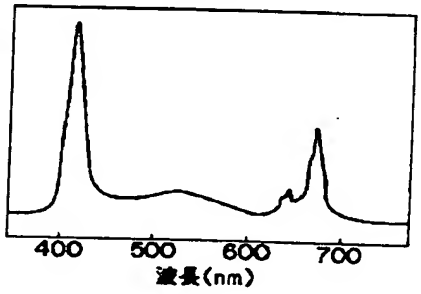
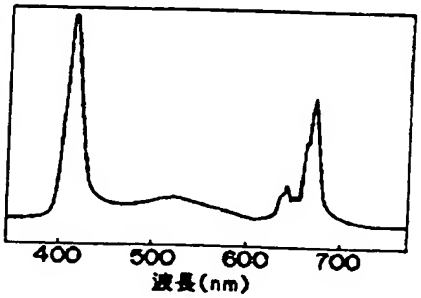
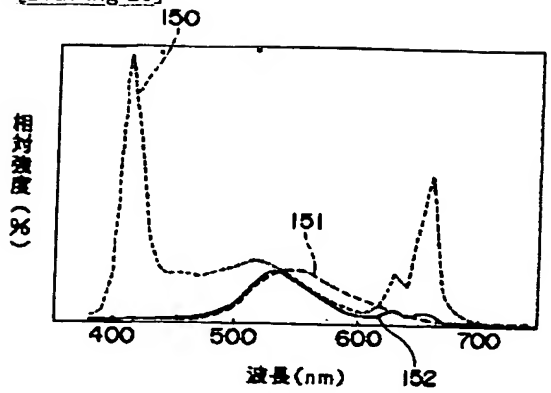


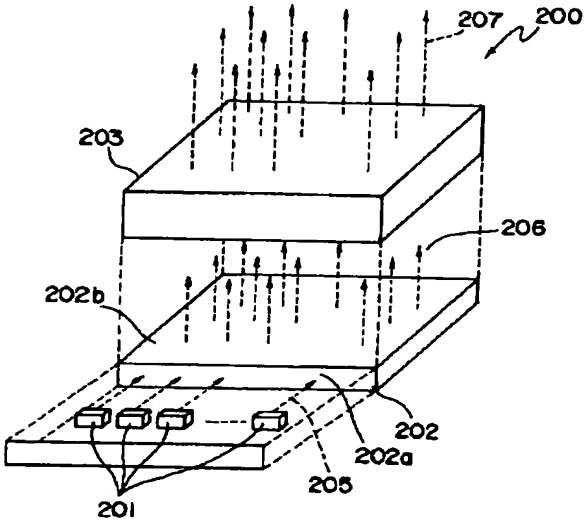
(c)



[Drawing 20]

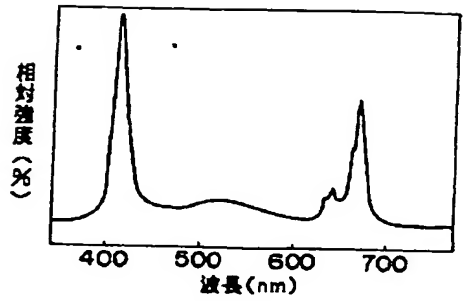


[Drawing 21]



[Drawing 19]

(a)



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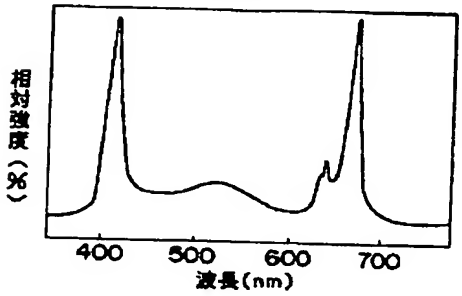

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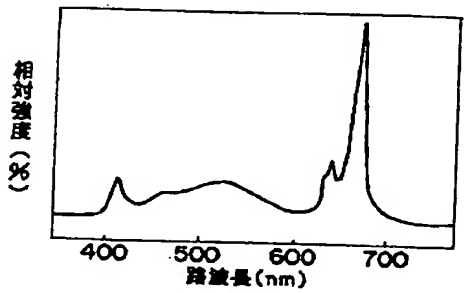
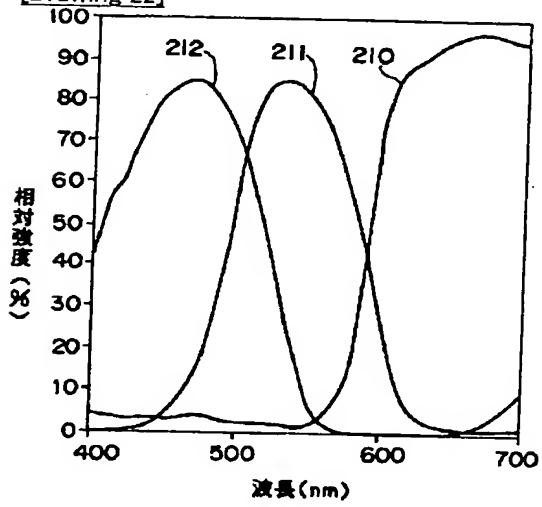


[Drawing 22]



[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（A）　(11)特許出願公開番号
特開2002－171000
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C09K 11/54 11/56 11/59		C09K 11/54 11/56 11/59	

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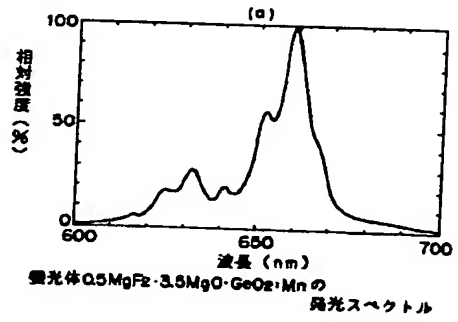
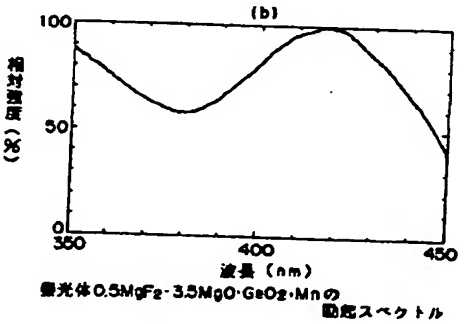
最終頁に続く

(54)【発明の名称】　半導体発光装置およびそれを用いた発光表示装置

(57)【要約】
【課題】　半導体発光素子からの出射光の影響が無く色調の良好な単色発光の半導体発光装置を提供すること。
【解決手段】　発光波長が３９０ｎｍ乃至４２０ｎｍで、人間の視感度が低い近紫外から紫青色の発光色を有する半導体発光素子を備え、この半導体発光素子の光の波長を、単色の発光ピークを有する蛍光体で変換する。蛍光体によって波長変換された光は、人間の視感度を考慮すると、見かけ上、半導体発光素子からの直接光の影響を殆ど受けないから、蛍光体からの光の色調は良好である。また、半導体発光装置の構造や半導体発光素子を変えることなく、蛍光体材料を変えるのみで所望の発光色を有する半導体発光装置が得られるので、半導体発光装置の製造コストを削減できる。



蛍光体0.5MgF₂·3.5MgO·GeO₂:Mnの発光スペクトル



蛍光体0.5MgF₂·3.5MgO·GeO₂:Mnの励起スペクトル

1

【特許請求の範囲】

【請求項１】　基体上に半導体発光素子を搭載してなる半導体発光装置において、

上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有し、

上記半導体発光素子からの出射光により励起されて、発光波長が６００ｎｍ乃至６７０ｎｍの波長領域に主発光ピークを有する赤色の光を出射する蛍光体を備えることを特徴とする半導体発光装置。

【請求項２】　上記蛍光体は、

M_2O_2S：Ｅｕ（但し、ＭはＬａ，Ｇｄ，Ｙから選ばれるいずれか一つまたは２以上の元素）、

$0.5MgF_2 \cdot 3.5MgO \cdot GeO_2$：Ｍｎ、

Y_2O_3：Ｅｕ、

Ｙ（Ｐ，Ｖ）O_4：Ｅｕ、

YVO_4：Ｅｕ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなることを特徴とする請求項１に記載の半導体発光装置。

【請求項３】　基体上に半導体発光素子を搭載してなる半導体発光装置において、

上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有し、

上記半導体発光素子からの出射光により励起されて、発光波長が５００ｎｍ乃至５４０ｎｍの波長領域に主発光ピークを有する緑色の光を出射する蛍光体を備えることを特徴とする半導体発光装置。

【請求項４】　上記蛍光体は、

$RMg_2Al_{16}O_{27}$：Ｅｕ，Ｍｎ（但し、ＲはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、

$RMgAl_{10}O_{17}$：Ｅｕ，Ｍｎ（但し、ＲはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、

ＺｎＳ：Ｃｕ、

$SrAl_2O_4$：Ｅｕ、

$SrAl_2O_4$：Ｅｕ，Ｄｙ、

ＺｎＯ：Ｚｎ、

Zn_2GeO_4：Ｍｎ、

Zn_2SiO_4：Ｍｎ、

$Q_3MgSi_2O_8$：Ｅｕ，Ｍｎ（但し、ＱはＳｒ，Ｂａ，Ｃａから選ばれるいずれか一つまたは２以上の元素）、で表される蛍光体の群のうち、いずれか一つまたは２以上からなることを特徴とする請求項３に記載の半導体発光装置。

【請求項５】　基体上に半導体発光素子を搭載してなる半導体発光装置において、

上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有し、

上記半導体発光素子からの出射光により励起されて、発光波長が４１０ｎｍ乃至４８０ｎｍの波長領域に主発光ピークを有する青色の光を出射する蛍光体を備えることを特徴とする半導体発光装置。

2

【請求項６】　上記蛍光体は、

$A_{10}(PO_4)_6Cl_2$：Ｅｕ（但し、ＡはＳｒ，Ｃａ，Ｂａ，Ｍｇ，Ｃｅから選ばれるいずれか一つまたは２以上の元素）、

$XMg_2Al_{16}O_{27}$：Ｅｕ（但し、ＸはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、

$XMgAl_{10}O_{17}$：Ｅｕ（但し、ＸはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、

ＺｎＳ：Ａｇ、

$Sr_{10}(PO_4)_6Cl_2$：Ｅｕ、

$Ca_{10}(PO_4)_6F_2$：Ｓｂ、

$Z_3MgSi_2O_8$：Ｅｕ（但し、ＺはＳｒ，Ｂａ，Ｃａから選ばれるいずれか一つまたは２以上の元素）、

$SrMgSi_2O_8$：Ｅｕ、

$Sr_2P_2O_7$：Ｅｕ、

$CaAl_2O_4$：Ｅｕ，Ｎｄ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなることを特徴とする請求項５に記載の半導体発光装置。

【請求項７】　基体上に半導体発光素子を搭載してなる半導体発光装置において、

上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有し、

上記半導体発光素子からの出射光により励起されて、発光波長が４８０ｎｍ乃至５００ｎｍの波長領域に主発光ピークを有する青緑色の光を出射する蛍光体を備えることを特徴とする半導体発光装置。

【請求項８】　上記蛍光体は、

$Sr_4Al_{14}O_{25}$：Ｅｕ、

$Sr_4Al_{14}O_{25}$：Ｅｕ，Ｄｙ、

$L_{10}(PO_4)_6Cl_2$：Ｅｕ（但し、ＬはＢａ，Ｃａ，Ｍｇから選ばれるいずれか一つまたは２以上の元素）、

$Sr_2Si_3O_8 \cdot 2SrCl_2$：Ｅｕ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなることを特徴とする請求項７に記載の半導体発光装置。

【請求項９】　基体上に半導体発光素子を搭載してなる半導体発光装置において、

上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有し、

上記半導体発光素子からの出射光により励起されて、発光波長が５７０ｎｍ乃至６００ｎｍの波長領域に主発光ピークを有する橙色の光を出射する蛍光体を備えることを特徴とする半導体発光装置。

【請求項１０】　上記蛍光体は、

ＺｎＳ：Ｍｎ、

ＺｎＳ：Ｃｕ，Ｍｎ，Ｃｏ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなることを特徴とする請求項９に記載の半導体発光装置。

【請求項１１】　上記基体の少なくとも一部と、上記半導体発光素子とを封止する封止樹脂を備え、

上記封止樹脂が上記蛍光体を含んでいることを特徴とす

る請求項１乃至１０のいずれか一つに記載の半導体発光装置。

【請求項１２】　上記基体はカップ形状のマウント部を有するリードフレームであり、

上記半導体発光素子は、上記リードフレームのカップ形状のマウント部の底に配置されており、かつ、もう一つのリードフレームにワイヤーボンディングによって電気的に接続されていて、

上記２つのリードフレームの少なくとも一部と上記半導体発光素子とが上記封止樹脂で封止されていることを特徴とする請求項１１に記載の半導体発光装置。

【請求項１３】　上記基体は、一対のリードフレームの先端に連結された絶縁体であり、

上記半導体発光素子は上記絶縁体に形成された金属配線に接続されていて、

上記一対のリードフレームの少なくとも一部と、上記絶縁体と、上記半導体発光素子とが上記封止樹脂で封止されていることを特徴とする請求項１１に記載の半導体発光装置。

【請求項１４】　上記基体は、カップ形状のマウント部を有するリードフレームであり、

上記半導体発光素子は、上記リードフレームのカップ形状のマウント部の底に配置されており、かつ、もう一つのリードフレームにワイヤーボンディングによって電気的に接続されていて、

上記カップ形状のマウント部に上記蛍光体が充填されていると共に、

上記２つのリードフレームの少なくとも一部と、上記半導体発光素子と、上記蛍光体とが封止樹脂で封止されていることを特徴とする請求項１乃至１０のいずれか一つに記載の半導体発光装置。

【請求項１５】　上記基体は、カップ形状のマウント部を有するリードフレームであり、

上記半導体発光素子は、上記リードフレームのカップ形状のマウント部の底に配置されており、かつ、もう一つのリードフレームにワイヤーボンディングによって電気的に接続されていて、

上記カップ形状のマウント部にコーティング部材を充填して、上記コーティング部材の上に上記蛍光体が配置されていると共に、

上記２つのリードフレームの少なくとも一部と、上記半導体発光素子と、上記コーティング部材と、上記蛍光体とが封止樹脂で封止されていることを特徴とする請求項１乃至１０のいずれか一つに記載の半導体発光装置。

【請求項１６】　上記基体は、金属配線が施された基板であり、

上記半導体発光素子は、上記基板の金属配線に電気的に接続されていて、

上記半導体発光素子を封止する封止樹脂を備え、

上記封止樹脂は上記蛍光体を含んでいることを特徴とする請求項１乃至１０のいずれか一つに記載の半導体発光装置。

【請求項１７】　上記基体は、金属配線が施された基板であり、

上記半導体発光素子は、上記基板の金属配線に電気的に接続されていると共に凹部内に配置されており、

上記蛍光体は上記凹部内に充填されていることを特徴とする請求項１乃至１０のいずれか一つに記載の半導体発光装置。

【請求項１８】　上記凹部は、上記基板に配置された枠によって形成されていることを特徴とする請求項１７に記載の半導体発光装置。

【請求項１９】　上記基体は、金属配線が施された基板であり、

上記半導体発光素子は、上記基板の金属配線に電気的に接続されていると共に凹部内に配置されており、

上記凹部に封止樹脂を充填すると共に、

上記封止樹脂の上に上記蛍光体が配置されていることを特徴とする請求項１乃至１０のいずれか一つに記載の半導体発光装置。

【請求項２０】　上記基体は、金属配線が施された基板であり、

上記半導体発光素子は、上記基板の金属配線と電気的に接続されており、

上記半導体発光素子からの出射光の少なくとも一部を反射する反射体を備え、

上記半導体発光素子を封止すると共に上記反射体からの反射光が透過する封止樹脂を備え、

上記蛍光体が上記封止樹脂に含まれていることを特徴とする請求項１乃至１０のいずれか一つに記載の半導体発光装置。

【請求項２１】　上記基体は、金属配線が施された基板であり、

上記半導体発光素子は、上記基板の上記金属配線と電気的に接続されており、

上記半導体発光素子からの出射光の少なくとも一部を反射する反射体を備え、

上記半導体発光素子から半導体発光装置の外部に直接出射する光を遮る遮蔽体を備え、

上記半導体発光素子を封止すると共に上記反射体からの反射光が透過する封止樹脂を備え、

上記蛍光体の層が、上記反射体において光が反射する面に設けられていることを特徴とする請求項１乃至１０のいずれか一つに記載の半導体発光装置。

【請求項２２】　上記基体は、金属配線が施された基板であり、

上記半導体発光素子は、上記基板の上記金属配線と電気的に接続されており、

少なくとも上記半導体発光素子の発光部分が上記基板の凹部内に配置されており、

上記半導体発光素子からの出射光の少なくとも一部を反射する反射体を備え、
上記半導体発光素子を封止すると共に上記反射体からの反射光が透過する封止樹脂を備え、
上記蛍光体の層が、上記反射体において光が反射する面に設けられていることを特徴とする請求項１乃至１０のいずれか一つに記載の半導体発光装置。
【請求項２３】　上記基体は、金属配線が施された基板であり、
上記半導体発光素子は、上記基板の上記金属配線と電気的に接続されており、
上記半導体発光素子からの出射光の少なくとも一部を反射する反射体を備え、
上記半導体発光素子を封止すると共に上記反射体からの反射光が透過する封止樹脂を備え、
上記蛍光体の層が、上記封止樹脂の光が出射する面に設けられていることを特徴とする請求項１乃至１０のいずれか一つに記載の半導体発光装置。
【請求項２４】　基体上に半導体発光素子を搭載してなる半導体発光装置において、
上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有し、
第１の蛍光体と、第２の蛍光体と、第３の蛍光体とを備え、
上記第１の蛍光体は、発光波長が６００ｎｍ乃至６７０ｎｍの波長領域に主発光ピークを有する赤色の出射光を有し、
上記第２の蛍光体は、発光波長が５００ｎｍ乃至５４０ｎｍの波長領域に主発光ピークを有する緑色の出射光を有し、
上記第３の蛍光体は、発光波長が４１０ｎｍ乃至４８０ｎｍの波長領域に主発光ピークを有する青色の出射光を有して、
上記第１、第２、第３の蛍光体からの出射光の色の和が、白色系であることを特徴とする半導体発光装置。
【請求項２５】　上記第１の蛍光体は、
M_2O_2S：Ｅｕ（但し、ＭはＬａ，Ｇｄ，Ｙから選ばれるいずれか一つまたは２以上の元素）、
$0.5MgF_2 \cdot 3.5MgO \cdot GeO_2$：Ｍｎ、
Y_2O_3：Ｅｕ、
Ｙ（Ｐ，Ｖ）O_4：Ｅｕ、
YVO_4：Ｅｕ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなり、
上記第２の蛍光体は、
$RMg_2Al_{16}O_{27}$：Ｅｕ，Ｍｎ（但し、ＲはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、
$RMgAl_{10}O_{17}$：Ｅｕ，Ｍｎ（但し、ＲはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、
ＺｎＳ：Ｃｕ、
$SrAl_2O_4$：Ｅｕ、

$SrAl_2O_4$：Ｅｕ，Ｄｙ、
ＺｎＯ：Ｚｎ、
Zn_2GeO_4：Ｍｎ、
Zn_2SiO_4：Ｍｎ、
$Q_3MgSi_2O_8$：Ｅｕ，Ｍｎ（但し、ＱはＳｒ，Ｂａ，Ｃａから選ばれるいずれか一つまたは２以上の元素）、で表される蛍光体の群のうち、いずれか一つまたは２以上からなり、
上記第３の蛍光体は、
$A_{10}(PO_4)_6Cl_2$：Ｅｕ（但し、ＡはＳｒ，Ｃａ，Ｂａ，Ｍｇ，Ｃｅから選ばれるいずれか一つまたは２以上の元素）、
$XMg_2Al_{16}O_{27}$：Ｅｕ（但し、ＸはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、
$XMgAl_{10}O_{17}$：Ｅｕ（但し、ＸはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、
ＺｎＳ：Ａｇ、
$Sr_{10}(PO_4)_6Cl_2$：Ｅｕ、
$Ca_{10}(PO_4)_6F_2$：Ｓｂ、
$Z_3MgSi_2O_8$：Ｅｕ（但し、ＺはＳｒ，Ｂａ，Ｃａから選ばれるいずれか一つまたは２以上の元素）、
$SrMgSi_2O_8$：Ｅｕ、
$Sr_2P_2O_7$：Ｅｕ、
$CaAl_2O_4$：Ｅｕ，Ｎｄ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなることを特徴とする請求項２４に記載の半導体発光装置。
【請求項２６】　上記第１、第２、第３の蛍光体は、総量が１００重量％であるとして、
上記第１の蛍光体が５０重量％以上７０重量％以下、
上記第２の蛍光体が７重量％以上２０重量％以下、
上記第３の蛍光体が２０重量％以上３０重量％以下であることを特徴とする請求項２４または２５に記載の半導体発光装置。
【請求項２７】　上記封止樹脂は、上記第１、第２、第３の蛍光体を含んでおり、
上記封止樹脂の重量に対する上記第１、第２、第３の蛍光体の総重量の比率が、０．５以上１以下であることを特徴とする請求項２６に記載の半導体発光装置。
【請求項２８】　請求項２４乃至２７のいずれか一つに記載の半導体発光装置を用いた光源と、
上記光源からの光を導く導光板と、
上記導光板からの光を透過させて分光する赤、緑、青のカラーフィルタとを備え、
上記半導体発光装置の出射光は、上記カラーフィルタの分光特性に適合した波長分布を有することを特徴とする発光表示装置。
【請求項２９】　半導体発光装置の出射光の波長分布が上記カラーフィルタの分光特性に適合するように、
上記半導体発光素子の発光波長と、
上記第１の蛍光体の発光波長と、

上記第２の蛍光体の発光波長と、
上記第３の蛍光体の発光波長と、
上記第１、第２、第３の蛍光体の混合比率と、
上記封止樹脂の重量に対する上記第１、第２、第３の蛍光体の総重量の比率とのうちの少なくとも一つを調節したことを特徴とする請求項２８に記載の発光表示装置。
【請求項３０】　上記発光表示装置は、液晶表示装置であることを特徴とする請求項２８または２９に記載の発光表示装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、液晶ディスプレイや携帯電話・携帯情報端末等のバックライト用光源や、屋内外公告等に利用されるＬＥＤ（発光ダイオード）表示装置、各々種携帯機器のインジケータ、照光スイッチ、ＯＡ（オフィスオートメーション）機器用光源等に利用される半導体発光装置に関するものであり、特に半導体発光素子からの出射光を、蛍光体を利用して波長変換し、様々な発光色の光源として利用可能な半導体発光装置と、それを用いた発光表示装置に関する。
【０００２】
【従来の技術】半導体発光装置は、小型で消費電力が少なく高輝度発光を安定に行えるので、各種表示装置における光源として広く用いられている。また、半導体発光装置は、各種情報処理装置における情報記録読み取り用の光源としても利用されている。これまでに広く実用化されている長波長可視光半導体発光装置に用いられる半導体発光素子は、使用される発光層の半導体材料や形成条件等により、赤から緑色の高輝度発光が可能であった。これに対して、近年、青から紫色の短波長可視光を発光する半導体発光素子が開発され、一般に実用化され始めてきている。
【０００３】これら様々な発光色の半導体発光装置を用いて、例えばＲ（赤），Ｇ（緑），Ｂ（青）の三原色の発光色を有する半導体発光装置を利用したＬＥＤディスプレイが市場に出始めている。
【０００４】さらに、青から紫色の短波長可視光を発光する半導体発光素子と蛍光体とを組み合わせて、半導体発光素子の出射光と蛍光体により波長変換された変換光との混色により白色を得る半導体発光装置が、例えば特許第２９２７２７９号に開示されている。
【０００５】また、特開平１０－１６３５３５号には、高輝度でコンパクトな白色の発光色を得るために、青色または青紫色の発光色を有する半導体発光素子と、この半導体発光素子からの光を吸収して可視領域の光を発光する１種または２種類以上の蛍光体とを組み合わせた半導体発光装置が開示されている。上記半導体発光素子の発光色と蛍光体の発光色とが互いに補色の関係になって、この半導体発光素子の発光色と蛍光体の発光色とが加色されて白色に発光するように、上記蛍光体を選択している。
【０００６】また、特開平１０－１２９２５号には、紫外光および近紫外光を出射する半導体発光素子と、この半導体発光素子からの光によって蛍光を発する蛍光体とを備える半導体発光装置が開示されている。上記半導体発光素子は、通常は青色の光を発する半導体発光素子であり、パルス状の大電流を流すことによって、紫外光および近紫外光を出射させている。上記蛍光体の種類を変えるのみによって、単一種類の半導体発光素子を用いて複数の発光色を得ることが開示されている。
【０００７】また、特開平９－１５３６４４号には、３族窒素化物半導体を用いて形成されてピーク波長が３８０ｎｍの紫外線を発光する発光層と、この発光層からの紫外線を受光して、赤、青、緑の３原色を各々発光する３種類の蛍光体層とを備えたドットマトリックスタイプの表示装置が開示されている。
【０００８】
【発明が解決しようとする課題】しかしながら、上記従来の技術は、以下のような問題点がある。
【０００９】長波長可視光半導体発光装置に用いられて赤から緑色の発光色を有する半導体発光素子や、青から紫色の短波長可視光を発光する半導体発光素子は、発光する波長に応じて使用される材料や素子形状が異なるので、互いに異なる波長の半導体素子を実装して半導体発光装置を得ようとすると、互いに異なる複数の実装材料や実装工程が必要となって、製造工程が煩雑となると共にコストアップの要因になるという問題がある。
【００１０】さらに、上記発光色が互いに異なる複数の半導体発光素子を用いて色彩が良好な白色光を得るためには、上記複数の半導体発光素子への電流を各々調整する必要があるので半導体発光装置が複雑になるという問題がある。また、上記半導体発光装置を複数個用いて発光表示装置を形成すると、大量の半導体発光素子の色調の調整が必要になって製造工程が煩雑になるという問題点がある。
【００１１】また、上記特許第２９２７２７９号や特開平１０－１６３５３５号に開示されている半導体発光装置は、半導体発光素子の出射光と、この出射光と補色の関係にある蛍光体の発光光とを混色して白色の発光色を得るので、光の利用効率が悪く、また、色調も良くないという問題点があった。例えば、半導体発光素子の青色の出射光と蛍光体の黄色の出射光との混色によって白色光を得る半導体発光装置を、液晶表示装置のバックライトとして利用すると、この白色光は純緑および純赤色の光量が少ないので、上記液晶表示装置が備える赤色カラーフィルタを透過する光の量が少ないから、上記液晶表示装置がフルカラー表示をすると、色抜けしたような印象を与えるという問題点がある。
【００１２】また、特開平１０－１２９２５号に開示されている半導体発光装置は、半導体発光素子にパルス状

9

の大電流を印加するので、半導体発光素子が破壊したり発熱して劣化して、寿命が短くて信頼性が低いという問題点がある。また、上記半導体発光素子は、紫外及び近紫外の波長に発光波長のピークを有すると共に、青色の波長にも発光波長のピークを有するので、この青色光が蛍光の発光光と混色して色調が悪いという問題がある。さらに、半導体発光装置が劣化した場合には、複数の異なる発光色を有する半導体発光素子が、輝度が一律に劣化するのではなくて、青色の波長成分が特に急激に低下するので、半導体発光装置の色調が変化してしまうという問題点がある。さらに、上記半導体発光素子は、近紫外（３９０ｎｍ）付近から短波長側の紫外領域の波長の光を出射するので、人体への影響を防止する施策が必要である。また、上記半導体発光素子の固定用およびモールド用の樹脂も、上記紫外領域の波長の光によって悪影響を受けるので、上記固定用樹脂の変質による信頼性の低下や、上記モールド用樹脂の黒化による発光輝度の低下を招く虞があるという問題点がある。

【００１３】特開平９―１５３６４４号に開示された半導体発光装置もまた、３８０ｎｍという紫外領域の発光波長を利用しているため、人体への影響を防止するために紫外領域の光の漏洩防止を施策する必要があると共に、半導体発光素子の固定用およびモールド用の樹脂が悪影響を受けて、信頼性の低下や発光輝度の低下の原因になるという問題点がある。さらに、この半導体発光装置は、基板上に、赤、青、緑の３原色を発光する蛍光体層を半導体層と共に形成するので、半導体発光装置の製造工程が煩雑で歩留りや信頼性が低下するという問題点がある。

【００１４】本発明は、上記の課題を解決するためになされたものであって、複数の発光波長の光を出射できるにも拘らず製造が容易で安価であり、色調が良好で、人体への影響が少なく、劣化が殆ど無い半導体発光装置と、それを用いた発光表示装置を提供することを目的とする。

【００１５】

【課題を解決するための手段】上記目的を達成するため、本発明の半導体発光装置は、基体上に半導体発光素子を搭載してなる半導体発光装置において、上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有し、上記半導体発光素子からの出射光により励起されて、発光波長が６００ｎｍ乃至６７０ｎｍの波長領域に主発光ピークを有する赤色の光を出射する蛍光体を備えることを特徴としている。

【００１６】本発明によれば、上記半導体発光装置において、上記半導体発光素子は人間の視感度が非常に低い短波長領域の出射光を有する上に、上記蛍光体は、発光波長が赤色の波長領域に主発光ピークを有して単色の赤色の光を出射するので、もし、上記蛍光体が出射する光と上記半導体発光素子からの直接の出射光とが混じっても、人間の視感度を考慮すると、見かけ上、上記蛍光体の出射光の色調が殆ど変化することがない。つまり、上記蛍光体からの光が、上記半導体発光素子からの直接光の影響を受けることなく半導体発光装置から出射されるのである。したがって、色調が良好な単色赤色発光の半導体発光装置が得られる。

10

【００１７】また、上記半導体発光装置において、上記半導体発光素子は発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有するので、例えば封止樹脂などの半導体発光装置の構成部品を損傷し難く、また、人体に有害な作用が殆ど無い。もし、半導体発光素子の発光波長が３９０ｎｍよりも短いと、例えば上記封止樹脂を損傷して不透明化や黒化などの不都合を生じさせる場合がある。一方、上記半導体発光素子の発光波長が４２０ｎｍよりも長いと、この半導体発光素子からの出射光は、可視領域の発光波長を有するようになるから、上記蛍光体からの出射光と混色して、半導体発光装置の発光色の色調が変化してしまう。したがって、上記半導体発光素子の発光波長を３９０ｎｍ乃至４２０ｎｍにすることによって、半導体発光装置の構成部品の劣化を少なくでき、また、人体に悪影響が殆どなく、しかも、色調が良好な半導体発光装置が得られる。

【００１８】１実施形態の半導体発光装置は、上記蛍光体は、

M_2O_2S：Ｅｕ（但し、ＭはＬａ，Ｇｄ，Ｙから選ばれるいずれか一つまたは２以上の元素）、

$0.5MgF_2 \cdot 3.5MgO \cdot GeO_2$：Ｍｎ、

Y_2O_3：Ｅｕ、

Ｙ（Ｐ，Ｖ）O_4：Ｅｕ、

ＹＶO_4：Ｅｕ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなる。

【００１９】上記実施形態によれば、発光波長が３９０ｎｍ乃至４２０ｎｍのいずれの出射光を有する半導体発光素子を用いても、上記半導体発光素子の出射光の波長に応じて上記蛍光体を選択できるので、発光波長が赤色の波長領域に良好な発光ピークを有する単色赤色発光の半導体発光装置が得られる。また、複数の蛍光体を組合わせることによって、半導体発光素子の出射光の波長領域の略全ての波長を赤色の波長に変換できるので、高効率な単色赤色発光の半導体発光装置が得られる。

【００２０】本発明の半導体発光装置は、基体上に半導体発光素子を搭載してなる半導体発光装置において、上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有し、上記半導体発光素子からの出射光により励起されて、発光波長が５００ｎｍ乃至５４０ｎｍの波長領域に主発光ピークを有する緑色の光を出射する蛍光体を備えることを特徴としている。

【００２１】本発明によれば、上記半導体発光装置において、上記半導体発光素子は人間の視感度が非常に低い短波長領域の出射光を有する上に、上記蛍光体は、発光

波長が緑色の波長領域に主発光ピークを有して単色の緑色の光を出射するので、もし、上記蛍光体が出射する光と上記半導体発光素子からの直接の出射光とが混じっても、人間の視感度を考慮すると、見かけ上、上記蛍光体の出射光の色調が殆ど変化することがない。つまり、上記蛍光体からの光が、上記半導体発光素子からの直接光の影響を受けることなく半導体発光装置から出射されるのである。したがって、色調が良好な単色緑色発光の半導体発光装置が得られる。

【００２２】また、上記半導体発光装置において、上記半導体発光素子は発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有するので、例えば封止樹脂などの半導体発光装置の構成部品を損傷し難く、また、人体に有害な作用が殆ど無い。もし、半導体発光素子の発光波長が３９０ｎｍよりも短いと、例えば上記封止樹脂を損傷して不透明化や黒化などの不都合を生じさせる場合がある。一方、上記半導体発光素子の発光波長が４２０ｎｍよりも長いと、この半導体発光素子からの出射光は、可視領域の発光波長を有するようになるから、上記蛍光体からの出射光と混色して、半導体発光装置の発光色の色調が変化してしまう。したがって、上記半導体発光素子の発光波長を３９０ｎｍ乃至４２０ｎｍにすることによって、半導体発光装置の構成部品の劣化を少なくでき、また、人体に悪影響が殆どなく、しかも、色調が良好な半導体発光装置が得られる。

【００２３】１実施形態の半導体発光装置は、上記蛍光体は、

$RMg_2Al_{16}O_{27}$：Ｅｕ，Ｍｎ（但し、ＲはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、

$RMgAl_{10}O_{17}$：Ｅｕ，Ｍｎ（但し、ＲはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、

ＺｎＳ：Ｃｕ、

$SrAl_2O_4$：Ｅｕ、

$SrAl_2O_4$：Ｅｕ，Ｄｙ、

ＺｎＯ：Ｚｎ、

$Zn_2Ge_2O_4$：Ｍｎ、

Zn_2SiO_4：Ｍｎ、

$Q_3MgSi_2O_8$：Ｅｕ，Ｍｎ（但し、ＱはＳｒ，Ｂａ，Ｃａから選ばれるいずれか一つまたは２以上の元素）、で表される蛍光体の群のうち、いずれか一つまたは２以上からなる。

【００２４】上記実施形態によれば、上記半導体発光素子の発光波長に応じて最適な蛍光体を選択できるので、発光波長が緑色の波長領域に良好な発光ピークを有する単色緑色発光の半導体発光装置が得られる。また、複数の蛍光体を組合わせることによって、半導体発光素子の出射光の波長領域の略全ての波長を緑色の波長に変換できるので、高効率の単色緑色発光の半導体発光装置が得られる。

【００２５】本発明の半導体発光装置は、基体上に半導体発光素子を搭載してなる半導体発光装置において、上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有し、上記半導体発光素子からの出射光により励起されて、発光波長が４１０ｎｍ乃至４８０ｎｍの波長領域に主発光ピークを有する青色の光を出射する蛍光体を備えることを特徴としている。

【００２６】本発明によれば、上記半導体発光装置において、上記半導体発光素子は人間の視感度が非常に低い短波長領域の出射光を有する上に、上記蛍光体は、発光波長が青色の波長領域に主発光ピークを有して単色の青色の光を出射するので、もし、上記蛍光体が出射する光と上記半導体発光素子からの直接の出射光とが混じっても、人間の視感度を考慮すると、見かけ上、上記蛍光体の出射光の色調が殆ど変化することがない。つまり、上記蛍光体からの光が、上記半導体発光素子からの直接光の影響を受けることなく半導体発光装置から出射されるのである。したがって、色調が良好な単色青色発光の半導体発光装置が得られる。

【００２７】また、上記半導体発光装置において、上記半導体発光素子は発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有するので、例えば封止樹脂などの半導体発光装置の構成部品を損傷し難く、また、人体に有害な作用が殆ど無い。もし、半導体発光素子の発光波長が３９０ｎｍよりも短いと、例えば上記封止樹脂を損傷して不透明化や黒化などの不都合を生じさせる場合がある。一方、上記半導体発光素子の発光波長が４２０ｎｍよりも長いと、この半導体発光素子からの出射光は、可視領域の発光波長を有するようになるから、上記蛍光体からの出射光と混色して、半導体発光装置の発光色の色調が変化してしまう。したがって、上記半導体発光素子の発光波長を３９０ｎｍ乃至４２０ｎｍにすることによって、半導体発光装置の構成部品の劣化を少なくでき、また、人体に悪影響が殆どなく、しかも、色調が良好な半導体発光装置が得られる。

【００２８】１実施形態の半導体発光装置は、上記蛍光体は、

$A_{10}(PO_4)_6Cl_2$：Ｅｕ（但し、ＡはＳｒ，Ｃａ，Ｂａ，Ｍｇ，Ｃｅから選ばれるいずれか一つまたは２以上の元素）、

$XMg_2Al_{16}O_{27}$：Ｅｕ（但し、ＸはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、

$XMgAl_{10}O_{17}$：Ｅｕ（但し、ＸはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、

ＺｎＳ：Ａｇ、

$Sr_{10}(PO_4)_6Cl_2$：Ｅｕ、

$Ca_{10}(PO_4)_6F_2$：Ｓｂ、

$Z_3MgSi_2O_8$：Ｅｕ（但し、ＺはＳｒ，Ｂａ，Ｃａから選ばれるいずれか一つまたは２以上の元素）、

$SrMgSi_2O_8$：Ｅｕ、

$Sr_2P_2O_7$：Ｅｕ、

$CaAl_2O_4$：Eu，Nd、で表される蛍光体の群のうち、いずれか一つまたは２以上からなる。

【００２９】上記実施形態によれば、半導体発光素子の発光波長に応じて最適な蛍光体を選択できるので、発光波長が青色の波長領域に良好な発光ピークを有する単色青色発光の半導体発光装置が得られる。また、複数の蛍光体を組合わせることによって、上記半導体発光素子の出射光の波長領域の略全ての波長を青色の波長に変換できるので、高効率な単色青色発光の半導体発光装置が得られる。

【００３０】本発明の半導体発光装置は、基体上に半導体発光素子を搭載してなる半導体発光装置において、上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有し、上記半導体発光素子からの出射光により励起されて、発光波長が４８０ｎｍ乃至５００ｎｍの波長領域に主発光ピークを有する青緑色の光を出射する蛍光体を備えることを特徴としている。

【００３１】本発明によれば、上記半導体発光装置において、上記半導体発光素子は人間の視感度が非常に低い短波長領域の出射光を有する上に、上記蛍光体は、発光波長が青緑色の波長領域に主発光ピークを有して単色の青緑色の光を出射するので、もし、上記蛍光体が出射する光と上記半導体発光素子からの直接の出射光とが混じっても、人間の視感度を考慮すると、見かけ上、上記蛍光体の出射光の色調が殆ど変化することがない。つまり、上記蛍光体からの光が、上記半導体発光素子からの直接光の影響を受けることなく半導体発光装置から出射されるのである。したがって、色調が良好な単色青緑色発光の半導体発光装置が得られる。

【００３２】また、上記半導体発光装置において、上記半導体発光素子は発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有するので、例えば封止樹脂などの半導体発光装置の構成部品を損傷し難く、また、人体に有害な作用が殆ど無い。もし、半導体発光素子の発光波長が３９０ｎｍよりも短いと、例えば上記封止樹脂を損傷して不透明化や黒化などの不都合を生じさせる場合がある。一方、上記半導体発光素子の発光波長が４２０ｎｍよりも長いと、この半導体発光素子からの出射光は、可視領域の発光波長を有するようになるから、上記蛍光体からの出射光と混色して、半導体発光装置の発光色の色調が変化してしまう。したがって、上記半導体発光素子の発光波長を３９０ｎｍ乃至４２０ｎｍにすることによって、半導体発光装置の構成部品の劣化を少なくでき、また、人体に悪影響が殆どなく、しかも、色調が良好な半導体発光装置が得られる。

【００３３】１実施形態の半導体発光装置は、上記蛍光体は、

$Sr_4Al_{14}O_{25}$：Eu、

$Sr_4Al_{14}O_{25}$：Eu，Dy、

$L_{10}(PO_4)_6Cl_2$：Eu（但し、LはＢａ，Ｃａ，

Ｍｇから選ばれるいずれか一つまたは２以上の元素）、

$Sr_2Si_3O_8 \cdot 2SrCl_2$：Eu、で表される蛍光体の群のうち、いずれか一つまたは２以上からなる。

【００３４】上記実施形態によれば、上記半導体発光素子の発光波長に応じて最適な蛍光体を選択できるので、発光波長が青緑色の波長領域に良好な発光ピークを有する単色青緑色発光の半導体発光装置が得られる。また、複数の蛍光体を組合わせることによって、上記半導体発光素子が出射する光の波長領域の略全ての波長を青緑色の波長に変換できるので、高効率な単色青緑色発光の半導体発光装置が得られる。

【００３５】本発明の半導体発光装置は、基体上に半導体発光素子を搭載してなる半導体発光装置において、上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有し、上記半導体発光素子からの出射光により励起されて、発光波長が５７０ｎｍ乃至６００ｎｍの波長領域に主発光ピークを有する橙色の光を出射する蛍光体を備えることを特徴としている。

【００３６】本発明によれば、上記半導体発光装置において、上記半導体発光素子は人間の視感度が非常に低い短波長領域の出射光を有する上に、上記蛍光体は、発光波長が橙色の波長領域に主発光ピークを有して単色の橙色の光を出射するので、もし、上記蛍光体が出射する光と上記半導体発光素子からの直接の出射光とが混じっても、人間の視感度を考慮すると、見かけ上、上記蛍光体の出射光の色調が殆ど変化することがない。つまり、上記蛍光体からの光が、上記半導体発光素子からの直接光の影響を受けることなく半導体発光装置から出射されるのである。したがって、色調が良好な単色橙色発光の半導体発光装置が得られる。

【００３７】また、上記半導体発光装置において、上記半導体発光素子は発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有するので、例えば封止樹脂などの半導体発光装置の構成部品を損傷し難く、また、人体に有害な作用が殆ど無い。もし、半導体発光素子の発光波長が３９０ｎｍよりも短いと、例えば上記封止樹脂を損傷して不透明化や黒化などの不都合を生じさせる場合がある。一方、上記半導体発光素子の発光波長が４２０ｎｍよりも長いと、この半導体発光素子からの出射光は、可視領域の発光波長を有するようになるから、上記蛍光体からの出射光と混色して、半導体発光装置の発光色の色調が変化してしまう。したがって、上記半導体発光素子の発光波長を３９０ｎｍ乃至４２０ｎｍにすることによって、半導体発光装置の構成部品の劣化を少なくでき、また、人体に悪影響が殆どなく、しかも、色調が良好な半導体発光装置が得られる。

【００３８】１実施形態の半導体発光装置は、上記蛍光体は、

ＺｎＳ：Ｍｎ、

ＺｎＳ：Ｃｕ，Ｍｎ，Ｃｏ、で表される蛍光体の群のう

15

ち、いずれか一つまたは２以上からなる。

【００３９】上記実施形態によれば、半導体発光素子の波長領域に応じて最適な蛍光体を選択できるので、発光波長が橙色の発光波長領域に主発光ピークを有する単色橙色発光の半導体発光装置を得ることができる。

【００４０】１実施形態の半導体発光装置は、上記基体の少なくとも一部と、上記半導体発光素子とを封止する封止樹脂を備え、上記封止樹脂が上記蛍光体を含んでいる。

【００４１】上記実施形態によれば、上記半導体発光素子を封止する封止樹脂が蛍光体を含んでいるので、半導体発光素子からの出射光は必ず波長変換されるから、半導体発光素子の光の利用効率がよい。また、封止樹脂を形成すると共に蛍光体を配置できるので、蛍光体を別個に配置する工程が不要であるから、半導体発光装置の製造が容易になる。

【００４２】また、この半導体発光装置は、発光波長が一定の波長領域を有する半導体発光素子と、所定の蛍光体とを組み合わせることによって、半導体発光素子および半導体発光装置の構造を変えることなく、所望の発光波長を有する半導体装置が得られる。すなわち、同一の製造工程で、蛍光体を変えることのみで、所望の発光波長を有する半導体発光発光装置が得られるので、半導体発光装置の製造コストを大幅に削減できる。

【００４３】１実施形態の半導体発光装置は、上記基体は、カップ形状のマウント部を有するリードフレームであり、上記半導体発光素子は、上記リードフレームのカップ形状のマウント部の底に配置されており、かつ、もう一つのリードフレームにワイヤーボンディングによって電気的に接続されていて、上記２つのリードフレームの少なくとも一部と上記半導体発光素子とが上記封止樹脂で封止されている。

【００４４】上記実施形態によれば、上記蛍光体を含む封止樹脂によって、上記カップ形状のマウント部によって集められた上記半導体発光素子からの出射光が、確実に波長変換されるので、指向性が良く、かつ、発光効率が良くて色調の良い半導体発光装置が得られる。

【００４５】１実施形態の半導体発光装置は、上記基体は、一対のリードフレームの先端に連結された絶縁体であり、上記半導体発光素子は上記絶縁体に形成された金属配線に接続されていて、上記一対のリードフレームの少なくとも一部と、上記絶縁体と、上記半導体発光素子とが上記封止樹脂で封止されている。

【００４６】上記実施形態によれば、上記半導体発光素子を、例えば金属バンプ等によって上記基板の金属配線に直接接続するので、半導体発光素子とリードフレームとを金属ワイヤー等で接続する手間が省かれる。また、上記封止樹脂に含まれる蛍光体によって、半導体発光素子からの出射光が確実に波長変換される。したがって、製造効率が良好で、しかも発光効率が良くて色調のよい

16

半導体発光装置が得られる。

【００４７】１実施形態の半導体発光装置は、上記基体は、カップ形状のマウント部を有するリードフレームであり、上記半導体発光素子は、上記リードフレームのカップ形状のマウント部の底に配置されており、かつ、もう一つのリードフレームにワイヤーボンディングによって電気的に接続されていて、上記カップ形状のマウント部に上記蛍光体が充填されていると共に、上記２つのリードフレームの少なくとも一部と、上記半導体発光素子と、上記蛍光体とが封止樹脂で封止されている。

【００４８】上記実施形態によれば、上記半導体発光素子からの光が集まるカップ形状のマウント部に蛍光体を充填するので、半導体発光素子からの光は確実に波長変換されて、光の利用効率が向上する。また、半導体発光素子からの光を集めない半導体発光装置と比較して、蛍光体を配置する領域が小さいので、上記蛍光体の使用量を少なくできる。

【００４９】１実施形態の半導体発光装置は、上記基体は、カップ形状のマウント部を有するリードフレームであり、上記半導体発光素子は、上記リードフレームのカップ形状のマウント部の底に配置されており、かつ、もう一つのリードフレームにワイヤーボンディングによって電気的に接続されていて、上記カップ形状のマウント部にコーティング部材を充填して、上記コーティング部材の上に上記蛍光体が配置されていると共に、上記２つのリードフレームの少なくとも一部と、上記半導体発光素子と、上記コーティング部材と、上記蛍光体とが封止樹脂で封止されている。

【００５０】上記実施形態によれば、上記蛍光体を、上記マウント部に充填されたコーティング部材の上に配置するので、上記マウント部内の全てに蛍光体を充填する場合に比べて、上記蛍光体の使用量が削減される。また、上記コーティング部材によって、上記半導体発光素子の発光部と蛍光体との間の距離が略均一になるので、色むらの無い均一発光の半導体発光装置が得られる。さらに、上記コーティング部材によって、上記半導体発光素子と蛍光体とが離間されるので、半導体発光素子による蛍光体の電気的および熱的劣化が殆どない。

【００５１】１実施形態の半導体発光装置は、上記基体は、金属配線が施された基板であり、上記半導体発光素子は、上記基板の金属配線に電気的に接続されていて、上記半導体発光素子を封止する封止樹脂を備え、上記封止樹脂は上記蛍光体を含んでいる。

【００５２】上記実施形態によれば、上記半導体発光素子は上記基板に、同一形状または単一種類の半導体発光素子を、例えばＡｕやＡｌ，Ｃｕ等の金属ワイヤーを用いて金属配線上に接続したり、あるいは、金属ワイヤー等を用いることなく金属バンプ等によって直接接続される。したがって、従来におけるように、発光色に対応して異なる形状の半導体発光素子を用いて異なる形状の半

導体発光装置を製造するよりも、半導体発光装置の製造過程が容易である。この半導体発光装置において、所望の波長に対応する所定の蛍光体を配置するのみによって、所望の発光波長を有する半導体発光装置が得られるので、従来に比べて半導体発光装置の製造が簡単、かつ、低コストになる。

【００５３】１実施形態の半導体発光装置は、上記基体は、金属配線が施された基板であり、上記半導体発光素子は、上記基板の金属配線に電気的に接続されると共に凹部内に配置されており、上記蛍光体は上記凹部内に充填されている。

【００５４】上記実施形態によれば、上記基板の凹部に上記蛍光体を充填するので、この蛍光体の使用量が少量になって、製造コストが安価で発光効率が良く、しかも、単色発光で色調が良い半導体発光装置が得られる。

【００５５】１実施形態の半導体発光装置は、上記凹部は、上記基板に配置された枠によって形成されている。

【００５６】上記実施形態によれば、上記基板に枠を配置して上記凹部を形成するので、基板を例えば切削して凹部を形成する加工の手間が削減される。また、上記枠を、例えば上記半導体発光素子側の側面の形状を、上記半導体発光素子からの出射光を集光する形状に加工することによって、上記出射光の波長の変換効率がさらに向上すると共に半導体発光装置の指向性が向上する。その結果、発光効率が良く、しかも単色発光で色調が良い半導体発光装置が得られる。

【００５７】１実施形態の半導体発光装置は、上記基体は、金属配線が施された基板であり、上記半導体発光素子は、上記基板の金属配線に電気的に接続されていると共に凹部内に配置されており、上記凹部に封止樹脂を充填すると共に、上記封止樹脂の上に上記蛍光体が配置されている。

【００５８】上記実施形態によれば、上記蛍光体を上記封止樹脂の上に配置するので、上記基板の凹部の内側に蛍光体を充填するよりも、さらに少量の蛍光体の使用量で、所望の発光波長を有する半導体発光装置が得られる。また、上記封止樹脂によって、半導体発光素子の発光部と蛍光体との間の距離が略均一になるので、色むらが殆ど無い均一発光の半導体発光装置が得られる。また、上記封止樹脂は、上位半導体発光素子と蛍光体とを離間させるので、上記蛍光体に対する半導体発光素子の電気的および熱的影響を低減できて、半導体発光装置の性能が安定する。

【００５９】１実施形態の半導体発光装置は、上記基体は、金属配線が施された基板であり、上記半導体発光素子は、上記基板の金属配線と電気的に接続されており、上記半導体発光素子からの出射光の少なくとも一部を反射する反射体を備え、上記半導体発光素子を封止すると共に上記反射体からの反射光が透過する封止樹脂を備え、上記蛍光体が上記封止樹脂に含まれている。

【００６０】上記実施形態によれば、上記半導体発光素子は上記基板に、同一形状または単一種類の半導体発光素子を、例えばＡｕやＡｌ，Ｃｕ等の金属ワイヤーを用いて金属配線上に接続したり、あるいは、金属ワイヤー等を用いることなく金属バンプ等によって直接接続される。したがって、従来におけるように、発光色に対応して異なる形状の半導体発光素子を用いて異なる形状の半導体発光装置を製造するよりも、半導体発光装置の製造過程が容易である。この半導体発光装置において、所望の波長に対応する所定の蛍光体を配置するのみによって、所望の発光波長を有する半導体発光装置が得られるので、従来に比べて半導体発光装置の製造が簡単、かつ、低コストになる。

【００６１】１実施形態の半導体発光装置は、上記基体は、金属配線が施された基板であり、上記半導体発光素子は、上記基板の上記金属配線と電気的に接続されており、上記半導体発光素子からの出射光の少なくとも一部を反射する反射体を備え、上記半導体発光素子から半導体発光装置の外部に直接出射する光を遮る遮蔽体を備え、上記半導体発光素子を封止すると共に上記反射体からの反射光が透過する封止樹脂を備え、上記蛍光体の層が、上記反射体において光が反射する面に設けられている。

【００６２】上記実施形態によれば、上記蛍光体の層は上記反射体において光が反射する面に設けられているので、この反射体で反射される光は確実に波長変換される。そして、上記半導体発光素子からの出射光は、上記遮蔽体によって半導体発光装置の外部に漏れることなく上記反射面で反射されて半導体発光装置外部に出射するので、殆ど全てが波長変換された光である。したがって、この半導体発光装置は、反射面のみに設けられて少ない蛍光体の使用量で、効率良く所望の発光色が得られる。さらに、上記蛍光体の層は、半導体発光素子から所定の距離をなす反射体の反射面に形成されるので、半導体発光素子の発光部と蛍光体との間の距離が略均一になって、色むらの無い均一発光の半導体発光装置が得られる。さらに、半導体発光素子と蛍光体とが離間されるので、蛍光体に対する半導体発光素子の電気的および熱的影響が緩和されて、半導体発光装置の性能が安定する。

【００６３】１実施形態の半導体発光装置は、上記基体は、金属配線が施された基板であり、上記半導体発光素子は、上記基板の上記金属配線と電気的に接続されており、少なくとも上記半導体発光素子の発光部分が上記基板の凹部内に配置されており、上記半導体発光素子からの出射光の少なくとも一部を反射する反射体を備え、上記半導体発光素子を封止すると共に上記反射体からの反射光が透過する封止樹脂を備え、上記蛍光体の層が、上記反射体において光が反射する面に設けられている。

【００６４】上記実施形態によれば、半導体発光素子は上記凹部内に配置されているので、半導体発光素子から

の光は半導体発光装置の外部へ直接出射されずに、必ず上記反射体で反射されて波長変換されてから半導体発光装置の外部に出射される。したがって、この半導体発光装置は、出射光の色調が良好になる。

【００６５】１実施形態の半導体発光装置は、上記基体は、金属配線が施された基板であり、上記半導体発光素子は、上記基板の上記金属配線と電気的に接続されており、上記半導体発光素子からの出射光の少なくとも一部を反射する反射体を備え、上記半導体発光素子を封止すると共に上記反射体からの反射光が透過する封止樹脂を備え、上記蛍光体の層が、上記封止樹脂の光が出射する面に設けられている。

【００６６】上記実施形態によれば、上記封止樹脂の光が出射する面に設けられた蛍光体の層によって、半導体発光素子からの出射光が、半導体発光装置から出射される直前に波長変換される。すなわち、この半導体発光装置からの光は全て波長変換されているので、良好な光の利用効率の半導体発光装置になる。また、上記蛍光体の層は、半導体発光素子から所定の距離をおいた位置にあるので、半導体発光素子の発光部と蛍光体との間の距離が略均一になって、色むらの無い均一発光の半導体発光装置が得られる。さらに、半導体発光素子と蛍光体とが離間されるので、蛍光体に対する半導体発光素子の電気的および熱的影響が緩和されて、半導体発光装置の性能が安定する。

【００６７】本発明の半導体発光装置は、基体上に半導体発光素子を搭載してなる半導体発光装置において、上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有し、第１の蛍光体と、第２の蛍光体と、第３の蛍光体とを備え、上記第１の蛍光体は、発光波長が６００ｎｍ乃至６７０ｎｍの波長領域に主発光ピークを有する赤色の出射光を有し、上記第２の蛍光体は、発光波長が５００ｎｍ乃至５４０ｎｍの波長領域に主発光ピークを有する緑色の出射光を有し、上記第３の蛍光体は、発光波長が４１０ｎｍ乃至４８０ｎｍの波長領域に主発光ピークを有する青色の出射光を有して、上記第１、第２、第３の蛍光体からの出射構の色の和が、白色系であることを特徴としている。

【００６８】上記構成によれば、上記半導体発光素子は人間の視感度が非常に低い短波長領域を有する上に、上記第１乃至第３の蛍光体が出射する光は、赤色，緑色，青色波長領域に各々発光波長の主ピークを有する単色の光であるので、もし、上記第１乃至第３の蛍光体からの出射光と上記半導体発光素子からの直接の出射光とが混じっても、人間の視感度を考慮すると、見かけ上、半導体発光装置の出射光の色調は殆ど変化しない。つまり、上記第１乃至第３のいずれの蛍光体からの光も、上記半導体発光素子からの直接光の影響を受けることが無い。したがって、色調が良好な白色系の発光色を有する半導体発光装置が得られる。また、半導体発光装置の出射光に関して、半導体発光素子から半導体発光装置外部に直接出射される光は、人間の可視領域において、蛍光体からの光と混色されていないから、半導体発光装置の長時間の使用の後に、経年変化によって半導体発光素子の発光性能が低下しても、半導体発光装置の輝度が低下するのみであって、色調が変化することがない。したがって、上記半導体発光装置は、色調が良好な白色系の光が安定して得られる。

【００６９】また、上記半導体発光装置において、上記半導体発光素子は発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有するので、例えば封止樹脂などの半導体発光装置の構成部品を損傷し難く、また、人体に有害な作用が殆ど無い。もし、半導体発光素子の発光波長が３９０ｎｍよりも短いと、例えば上記封止樹脂を損傷して不透明化や黒化などの不都合を生じさせる場合がある。したがって、上記半導体発光素子の発光波長を３９０ｎｍ乃至４２０ｎｍにすることによって、半導体発光装置の構成部品の劣化を少なくでき、また、人体に悪影響が殆どなく、しかも、色調が良好な半導体発光装置が得られる。

【００７０】１実施形態の半導体発光装置は、上記第１の蛍光体は、

M_2O_2S：Ｅｕ（但し、ＭはＬａ，Ｇｄ，Ｙから選ばれるいずれか一つまたは２以上の元素）、

$0.5MgF_2 \cdot 3.5MgO \cdot GeO_2$：Ｍｎ、

Y_2O_3：Ｅｕ、

Ｙ（Ｐ，Ｖ）O_4：Ｅｕ、

YVO_4：Ｅｕ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなり、上記第２の蛍光体は、

$RMg_2Al_{16}O_{27}$：Ｅｕ，Ｍｎ（但し、ＲはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、

$RMgAl_{10}O_{17}$：Ｅｕ，Ｍｎ（但し、ＲはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、

ＺｎＳ：Ｃｕ、

$SrAl_2O_4$：Ｅｕ、

$SrAl_2O_4$：Ｅｕ，Ｄｙ、

ＺｎＯ：Ｚｎ、

$Zn_2Ge_2O_4$：Ｍｎ、

Zn_2SiO_4：Ｍｎ、

$Q_3MgSi_2O_8$：Ｅｕ，Ｍｎ（但し、ＱはＳｒ，Ｂａ，Ｃａから選ばれるいずれか一つまたは２以上の元素）、で表される蛍光体の群のうち、いずれか一つまたは２以上からなり、上記第３の蛍光体は、

$A_{10}(PO_4)_6Cl_2$：Ｅｕ（但し、ＡはＳｒ，Ｃａ，Ｂａ，Ｍｇ，Ｃｅから選ばれるいずれか一つまたは２以上の元素）、

$XMg_2Al_{16}O_{27}$：Ｅｕ（但し、ＸはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、

$XMgAl_{10}O_{17}$：Ｅｕ（但し、ＸはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、

ＺｎＳ：Ａｇ、
$Sr_{10}(PO_4)_6Cl_2$：Ｅｕ、
$Ca_{10}(PO_4)_6F_2$：Ｓｂ、
$Z_3MgSi_2O_8$：Ｅｕ（但し、ＺはＳｒ，Ｂａ，Ｃａから選ばれるいずれか一つまたは２以上の元素）、
$SrMgSi_2O_8$：Ｅｕ、
$Sr_2P_2O_7$：Ｅｕ、
$CaAl_2O_4$：Ｅｕ，Ｎｄ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなる。

【００７１】上記実施形態によれば、発光波長が３９０ｎｍ乃至４２０ｎｍのうちのいずれの発光波長を有する半導体発光素子を用いても、この半導体発光素子の発光波長に対応して上記複数の蛍光体から適切な蛍光体を選択することによって、単色の赤色、および、緑色、および、青色の発光光が各々得られる。これによって、赤色、緑色、青色の波長の光が各々適切に混色されて、良好な色調の白色系の発光色が得られる。また、複数の蛍光体を組合わせることによって、半導体発光素子が有する波長領域の略全ての波長の光を、赤色、緑色、青色の波長に各々変換することができるので、半導体発光素子の出射光の利用効率が向上して、高効率な白色系発光の半導体発光装置が得られる。

【００７２】１実施形態の半導体発光装置は、上記第１、第２、第３の蛍光体は、総量が１００重量％であるとして、上記第１の蛍光体が５０重量％以上７０重量％以下、上記第２の蛍光体が７重量％以上２０重量％以下、上記第３の蛍光体が２０重量％以上３０重量％以下である。

【００７３】上記実施形態によれば、上記第１の蛍光体が５０重量％以上７０重量％以下、上記第２の蛍光体が７重量％以上２０重量％以下、上記第３の蛍光体が２０重量％以上３０重量％以下であるので、上記第２の蛍光体が出射する緑色の光に比べて視感度が低い第１の蛍光体が出射する赤色、および第３の蛍光体が出射する青色の光の強度が強められる。したがって、人間の視感度が考慮されて、良好な色調の白色系発光の半導体発光装置が得られる。

【００７４】ここにおいて、半導体発光装置の発光色は、第１の蛍光体の混合比率が５０重量％より少ないと、緑色がかった色調の白色になる一方、上記第１の蛍光体の混合比率が７０重量％より多いと、赤色がかった色調の白色になる。また、上記半導体発光装置の発光色は、第２の蛍光体の混合比率が７重量％より少ないと、赤色がかった色調の白色になり、上記第２の蛍光体の混合比率が２０重量％より多いと、緑色がかった色調の白色になる。また、上記半導体発光装置の発光色は、第３の蛍光体の混合比率が２０重量％より少ないと、赤色がかった色調の白色になり、上記第３の蛍光体の混合比率が３０重量％より多いと、緑色がかった色調の白色になる。

【００７５】１実施形態の半導体発光装置は、上記封止樹脂は、上記第１、第２、第３の蛍光体を含んでおり、上記封止樹脂の重量に対する上記第１、第２、第３の蛍光体の総重量の比率が、０．５以上１以下である。

【００７６】上記実施形態によれば、上記封止樹脂の重量に対する上記蛍光体の総重量の比率を、０．５以上１以下にすることによって、自然光に近い白色系の光を出射する半導体発光装置が得られる。なお、上記比率が１より大きくなると、半導体発光装置の出射光の輝度は明るくなると共に色調が青白くなる一方、上記比率が０．５より小さくなると、半導体発光装置の出射光の輝度が暗くなると共に色調が赤味を帯びてしまう。

【００７７】１実施形態の発光表示装置は、上記半導体発光装置を用いた光源と、上記光源からの光を導く導光板と、上記導光板からの光を透過させて分光する赤、緑、青のカラーフィルタとを備え、上記半導体発光装置の出射光は、上記カラーフィルタの分光特性に適合した波長分布を有する。

【００７８】上記実施形態によれば、上記半導体発光装置からの出射光は、上記赤、緑、青のカラーフィルタの分光特性に適合した波長分布を有するので、このカラーフィルタによって、発光波長が赤色の波長領域にピークを有する光と、発光波長が緑色の波長領域にピークを有する光と、発光波長が青色の波長領域にピークを有する光とに、各々適切な強度を有して分光されるから、半導体発光装置の光の利用効率が良好で、しかも、高輝度な発光表示装置になる。

【００７９】１実施形態の発光表示装置は、半導体発光装置の出射光の波長分布が上記カラーフィルタの分光特性に適合するように、上記半導体発光素子の発光波長と、上記第１の蛍光体の発光波長と、上記第２の蛍光体の発光波長と、上記第３の蛍光体の発光波長と、上記第１、第２、第３の蛍光体の混合比率と、上記封止樹脂の重量に対する上記第１、第２、第３の蛍光体の総重量の比率とのうちの少なくとも一つを調節している。

【００８０】上記実施形態によれば、上記半導体発光装置からの出射光が上記カラーフィルタの分光特性に適合するように確実かつ効果的に調節されるので、上記発光表示装置からの出射光は、上記カラーフィルタによって、強度が比較的大きくて略単色の赤色と、緑色と、青色とに分光されるから、上記発光表示装置は、色抜けなどが無くて高輝度かつ高コントラストのフルカラー表示になる。

【００８１】１実施形態の発光表示装置は、上記発光表示装置は、液晶表示装置である。

【００８２】上記実施形態によれば、色抜けが殆ど無く、高輝度かつ高コントラストの液晶表示装置が得られる。

【００８３】

【発明の実施形態】以下、本発明を図示の実施形態によ

り詳細に説明する。

【００８４】図１（ａ），（ｂ），（ｃ）は、本発明の実施形態において用いられる半導体発光素子を示す断面図である。

【００８５】図１（ａ）は、絶縁性の半導体材料からなる基板を有する半導体発光素子を示す断面図である。この半導体発光素子７ａは、絶縁性のサファイア基板１ａ上に、Ｎ型窒化ガリウム系化合物半導体層２、Ｐ型窒化ガリウム系化合物半導体層３と、金属薄膜または透明導電膜からなるＰ型層用電極４とを順に積層している。上記Ｎ型窒化ガリウム系化合物半導体層２の図１（ａ）において右側に形成された露出面上にＮ型用パッド電極５が形成されていると共に、上記Ｐ型層用電極４表面上にＰ型用パッド電極６が形成されている。上記Ｎ型用パッド電極５およびＰ型用パッド電極６の間に電流を流すと、発光領域８ａから発光する。

【００８６】図１（ｂ）は、導電性の半導体材料からなる基板を有する半導体発光素子を示す断面図である。この半導体発光素子７ｂは、導電性の窒化ガリウム半導体基板１ｂ上に、Ｎ型窒化ガリウム系化合物半導体層２、Ｐ型窒化ガリウム系化合物半導体層３、金属薄膜または透明導電膜からなるＰ型層用電極４を順次積層して形成されている。上記半導体基板１ｂの下面にＮ型用パッド電極５が形成されていると共に、上記Ｐ型層用電極４の上面にＰ型用パッド電極６が形成されている。上記Ｎ型用パッド電極５とＰ型用パッド電極６との間に電流を流すと、発光領域８ｂから発光する。

【００８７】図１（ｃ）は、基板を透過させて光を取り出すタイプの半導体発光素子を示す断面図である。この半導体発光素子７ｃは、絶縁性のサファイア基板１ａ上（図１（ｃ）においてはサファイア基板１ａの下方）に、Ｎ型窒化ガリウム系化合物半導体層２、Ｐ型窒化ガリウム系化合物半導体層３、金属薄膜または透明導電膜からなるＰ型層用電極４を順次積層して、上記Ｎ型窒化ガリウム系化合物半導体層２の露出面にＮ型用パッド電極５を形成すると共に、Ｐ型層用電極４の表面にＰ型用パッド電極６を形成している。そして、図１（ｃ）に示すように、上記Ｎ型用パッド電極５およびＰ型用パッド電極６を、例えばＡｕ等からなる金属バンプ１６ａ，１６ｂによって、半導体発光素子７ｃの下方に配置した図示しないサブマウントの金属配線等に直接ボールボンディングする。上記Ｎ型用パッド電極５とＰ型用パッド電極６との間に電流を流すと、発光領域８から発光し、この発光光は上記サファイア基板１ａを透過して図１（ｃ）において上方に放射される。

【００８８】なお、上記半導体発光素子７ａ，７ｃの絶縁性サファイア基板１ａは、ＺｎＯ，ＧａＮ，ＳｉＣ，ＺｎＳｅ等の他の材料を用いてもよい。また、上記半導体発光素子７ｂにおける導電性の窒化ガリウム半導体基板１ｂは、ＳｉＣ，ＺｎＳｅ，Ｓｉ等の他の材料を用いてもよい。この導電性の半導体基板１ｂを備えた半導体発光素子７ｂは、上記半導体基板１ｂの下面にも電極を形成して、半導体発光素子７ｂの上下両面に電極を形成できるので、絶縁体基板１ａを有して片面に２つの電極を配置する半導体発光素子７ａ，７ｂに較べて、同一のサイズで半導体層の発光領域を広く形成できると共にリードフレームや実装基板への実装が容易であるという利点がある。

【００８９】上記半導体発光素子７ａ，７ｂ，７ｃにおける半導体層の材料としては、窒化物系化合物半導体（ＩｎｘＧａｙＡｌｚＮ（ｘ＋ｙ＋ｚ＝１，０≦ｘ≦１，０≦ｙ≦１，０≦ｚ≦１））が好適に利用できるが、それ以外にＳｉＣやＺｎＳｅ等の半導体材料を用いてもよい。

【００９０】上記半導体発光素子７ａ，７ｂ，７ｃは、波長領域が３９０ｎｍから４２０ｎｍまでの光を発光する。この波長領域の光に対する人間の視感度は非常に低いため、この波長領域の光を他の波長の光に変換する蛍光体を用いると、この蛍光体によって変換された光の色のみが発光色として認識されて、良好な色調を有する半導体発光装置が得られる。半導体発光素子の波長が４２０ｎｍよりも長いと、人間の目には可視光として認識され易くなり、蛍光体によって波長変換された光が半導体発光素子からの直接の出射光と混ざって、発光色の色調が悪くなってしまう。また、半導体発光素子の波長が３９０ｎｍよりも短いと、この光は人体に有害な紫外線になると共に、半導体発光装置に使用されている樹脂部分に対して例えばモールド樹脂を黒化して輝度を低下させたり、樹脂を変質させて信頼性を低下させるといった悪影響を及ぼす。

【００９１】次に、本発明の半導体発光装置に用いられる蛍光体に関して詳細に述べる。

【００９２】下記の表１および表２は、発光波長のピークが４１０ｎｍの窒化ガリウム系化合物半導体を発光素子として作成した半導体発光素子を用いて、各種蛍光体を励起して発光輝度を評価した結果を示した表である。また、上記蛍光体を励起して得られた発光のピーク波長（ｎｍ）も同時に示している。発光の輝度の評価は、赤色，緑色，青色，青緑色，橙色の各発光色において、蛍光体毎の発光輝度を比較して優劣を評価し、発光輝度が優秀なものには◎を、普通のものには○を、やや劣るものには△を、劣るものには×を付した。表１は、発光色が赤色および緑色の蛍光体についてのピーク波長および輝度の評価結果を示し、表２は、発光色が青色および青緑色、橙色の蛍光体についてのピーク波長および輝度の評価結果を示している。

【００９３】

【表１】

発光色	蛍光体	発光ピーク波長（nm）	評価
赤色	$La_2O_2S:Eu$	623	◎
	$Gd_2O_2S:Eu$	625	○
	$Y_2O_2S:Eu$	626	△
	$0.5MgF_2\cdot 3.5MgO\cdot GeO_2:Mn$	658	◎
	$Y_2O_3:Eu$	611	△
	$Y(P,V)O_4:Eu$	618	△
	$YVO_4:Eu$	618	△
	$CaS:Eu$	655	○
	$CaS:Eu,Tm$	650	◎
緑色	$BaMg_2Al_{10}O_{27}:Eu,Mn$	515	○
	$BaMgAl_{10}O_{17}:Eu,Mn$	512	○
	$ZnS:Cu$	527	△
	$SrAl_2O_4:Eu$	522	◎
	$SrAl_2O_4:Eu,Dy$	522	○
	$ZnO:Zn$	508	△
	$Zn_2Ge_2O_4:Mn$	537	○
	$Zn_2SiO_4:Mn$	525	○
	$Ba_3MgSi_2O_8:Eu,Mn$	512	○
	$Sr_3MgSi_2O_8:Eu,Mn$	532	○

【００９４】

【表２】

27　　28

発光色	蛍光体	発光ピーク波長（ｎｍ）	評価
青色	$(Sr, Ca, Ba, Ce)_{10}(PO_4)_6Cl_2:Eu$	４５７	◎
	$BaMg_2Al_{16}O_{27}:Eu$	４５５	◎
	$BaMgAl_{10}O_{17}:Eu$	４５２	○
	$ZnS:Ag$	４５０	△
	$Sr_{10}(PO_4)_6Cl_2:Eu$	４４７	○
	$Ca_{10}(PO_4)_6F_2:Sb$	４８０	△
	$Sr_3MgSi_2O_8:Eu$	４６２	○
	$SrMgSi_2O_6:Eu$	４６０	△
	$SrAl_{12}O_{19}:Eu$	４００	×
	$Sr_2P_2O_7:Eu$	４２０	△
	$CaAl_2O_4:Eu, Nd$	４４０	△
青緑色	$Sr_4Al_{14}O_{25}:Eu$	４９２	◎
	$Sr_4Al_{14}O_{25}:Eu, Dy$	４９２	◎
	$(Ba, Ca, Mg)_{10}(PO_4)_6Cl_2:Eu$	４８２	○
	$Sr_2Si_3O_8\cdot 2SrCl_2:Eu$	４９０	△
橙色	$ZnS:Mn$	５８６	○
	$ZnS:Cu, Mn, Co$	５８０	○

表１から分かるように、高い輝度の赤色の発光色を得るためには、$La_2O_2S:Eu$、０．５MgF_2・３．５$MgO\cdot GeO_2:Mn$、$CaS:Eu$，Tmの蛍光体が好適であり、高い輝度の緑色の発光色を得るためには、$SrAl_2O_4:Eu$の蛍光体が好適である。また、表２から分かるように、高い輝度の青色の発光色を得るためには、$(Sr, Ca, Ba, Ce)_{10}(PO_4)_6Cl_2:Eu$の蛍光体が好適であり、高い輝度の青緑色の発光色を得るためには、$Sr_4Al_{14}O_{25}:Eu$、$Sr_4Al_{14}O_{25}:Eu$，Dyの蛍光体が好適である。

【００９５】図２乃至７は、本発明の実施形態に用いられる主な蛍光体の発光スペクトル及び励起スペクトルを示した図である。いずれの図も、横軸は波長（ｎｍ）であり、縦軸は相対強度（％）である。

【００９６】本発明に用いられる半導体発光素子の発光波長は、３９０ｎｍ乃至４２０ｎｍである。より最適な発光波長範囲は、半導体発光素子の発光波長により励起される蛍光体の種類や、蛍光体の発光色により変わってくる。

【００９７】例えば、図２（ａ）に示す蛍光体０．５MgF_2・３．５$MgO\cdot GeO_2:Mn$によって、６５８ｎｍに発光波長ピークを有する赤色の発光色を得ようとする場合、図２（ｂ）から明らかなように、４１０ｎｍ乃至４２０ｎｍの波長範囲に発光波長のピークを有する半導体発光素子によって上記蛍光体を励起するのが効果的である。

【００９８】一方、図３（ａ）に示す蛍光体$La_2O_2S:Eu$で、６２３ｎｍに発光波長ピークを有する赤色の発光色を得ようとする場合、図３（ｂ）から明らかなように、３９０ｎｍの発光波長を有する半導体発光素子によって上記蛍光体を励起するのが効果的である。

【００９９】本来、蛍光体０．５MgF_2・３．５$MgO\cdot GeO_2:Mn$および$La_2O_2S:Eu$の励起波長のピークは３９０ｎｍより短波長側にあるが、蛍光体を励起する半導体発光素子の発光波長が３９０ｎｍより短いと、人体に有害な紫外線を放出することとなるので実用的ではなく、また、半導体発光装置に使用されている樹脂部分にも悪影響を与え、封止樹脂の黒化による輝度の低下や樹脂の変質による信頼性の低下の原因となる。

【０１００】上記蛍光体以外にも、本発明の実施形態では、$Gd_2O_2S:Eu$、$Y_2O_2S:Eu$、$Y_2O_3:Eu$、$Y(P, V)O_4:Eu$、$YVO_4:Eu$等が利用可能である。また、これらの蛍光体を複数用いることで、より効果的に半導体発光素子の出射光を用いて、発光波長のピークが６００ｎｍ乃至６７０ｎｍの赤色の光に変換することができる。

【０１０１】また、図４（ａ）に示す蛍光体$BaMg_2Al_{16}O_{27}:Eu, Mn$で、５１５ｎｍに発光波長ピークを有する緑色の発光色を得ようとする場合、図４（ｂ）から明らかなように、３９０ｎｍの発光波長を有する半導体発光素子によって上記蛍光体を励起するのが

効果的である。

【０１０２】一方、図５（ａ）に示す蛍光体$SrAl_2O_4$：Ｅｕで、５２２ｎｍに発光波長ピークを有する緑色の発光色を得ようとする場合、図５（ｂ）から明らかなように、３９０ｎｍ乃至４２０ｎｍの波長範囲に発光波長のピークを有する半導体発光素子によって上記蛍光体を励起するのが効果的である。

【０１０３】本来、蛍光体$BaMg_2Al_{16}O_{27}$：Ｅｕ，Ｍｎ及び$SrAl_2O_4$：Ｅｕの励起波長のピークは３９０ｎｍより短波長側にあるが、蛍光体を励起する半導体発光素子の発光波長が３９０ｎｍより短いと、人体に有害な紫外線を放出することとなるので実用的ではなく、また、半導体発光装置に使用されている樹脂部分にも悪影響を与え、封止樹脂の黒化による輝度の低下や樹脂の変質による信頼性の低下の原因となる。

【０１０４】上記蛍光体以外にも、本発明の実施形態では、ＺｎＳ：Ｃｕ、$SrAl_2O_4$：Ｅｕ，Ｄｙ、ＺｎＯ：Ｚｎ、$Zn_2Ge_2O_4$：Ｍｎ、Zn_2SiO_4：Ｍｎ、$Ba_3MgSi_2O_8$：Ｅｕ，Ｍｎ、$Sr_3MgSi_2O_8$：Ｅｕ，Ｍｎ等が利用可能である。また、これらの蛍光体を複数用いることで、より効果的に半導体発光素子の出射光を用いて、発光波長のピークが５００ｎｍ乃至５４０ｎｍの緑色の光に変換することができる。

【０１０５】また、図６（ａ）に示す蛍光体$(Sr, Ca, Ba, Ce)_{10}(PO_4)_6Cl_2$：Ｅｕで、４５７ｎｍに発光波長ピークを有する青色の発光色を得ようとする場合、図６（ｂ）から明らかなように、３９０ｎｍ乃至４００ｎｍの波長範囲に発光波長のピークを有する半導体発光素子によって上記蛍光体を励起するのが効果的である。本来、蛍光体$(Sr, Ca, Ba, Ce)_{10}(PO_4)_6Cl_2$：Ｅｕの励起波長のピークは３９０ｎｍより短波長側にあるが、蛍光体を励起する半導体発光素子の発光波長が３９０ｎｍより短いと、人体に有害な紫外線を放出することとなるので実用的ではなく、また、半導体発光装置に使用されている樹脂部分にも悪影響を与え、封止樹脂の黒化による輝度の低下や樹脂の変質による信頼性の低下の原因となる。

【０１０６】一方、図７（ａ）に示す蛍光体$BaMgAl_{10}O_{17}$：Ｅｕで、４５２ｎｍに発光波長ピークを有する青色の発光色を得ようとする場合、図７（ｂ）から明らかなように、３９０ｎｍの発光波長を有する半導体発光素子によって上記蛍光体を励起するのが効果的である。本来、蛍光体$BaMgAl_{10}O_{17}$：Ｅｕの励起波長のピークは３９０ｎｍにあるが、蛍光体を励起する半導体発光素子の発光波長が３９０ｎｍより短いと、人体に有害な紫外線を放出することとなるので実用的ではなく、また、半導体発光装置に使用されている樹脂部分にも悪影響を与え、封止樹脂の黒化による輝度の低下や樹脂の変質による信頼性の低下の原因となる。

【０１０７】上記蛍光体以外にも、本発明の実施形態では、$BaMg_2Al_{16}O_{27}$：Ｅｕ、ＺｎＳ：Ａｇ、$Sr_{10}(PO_4)_6Cl_2$：Ｅｕ、$Ca_{10}(PO_4)_6F_2$：Ｓｂ、$Sr_3MgSi_2O_8$：Ｅｕ、$SrMgSi_2O_8$：Ｅｕ、$Sr_2P_2O_7$：Ｅｕ、$CaAl_2O_4$：Ｅｕ，Ｎｄ等が利用可能である。また、これらの蛍光体を複数用いることで、より効果的に半導体発光素子の出射光を、発光波長のピークが４１０ｎｍ乃至４８０ｎｍの青色の光に変換することができる。

【０１０８】さらに、使用用途に応じて、$Sr_4Al_{14}O_{25}$：Ｅｕ、$Sr_4Al_{14}O_{25}$：Ｅｕ，Ｄｙ、$(Ba, Ca, Mg)_{10}(PO_4)_6Cl_2$：Ｅｕ、$Sr_2Si_3O_8 \cdot 2SrCl_2$：Ｅｕ等の蛍光体のうちのいずれか一つ、または、複数を用いることによって、効果的に半導体発光素子の出射光を、発光波長のピークが４８０ｎｍ乃至５００ｎｍの青緑色の光に変換することができる。

【０１０９】また、蛍光体に、ＺｎＳ：Ｍｎ、ＺｎＳ：Ｃｕ，Ｍｎ，Ｃｏを用いることにより、半導体発光素子の出射光を、発光波長のピークが５７０ｎｍ乃至６００ｎｍの橙色の光に変換することができる。

【０１１０】以下、本発明の実施形態の半導体発光装置について図面を参照して詳しく説明する。

【０１１１】（第１の実施形態）図８（ａ）乃至（ｃ）は、本発明の第１の実施形態の半導体発光装置を示す断面図である。

【０１１２】図８（ａ）は、絶縁性基板を有する半導体発光素子７ａを備え、蛍光体を分散させたランプ形状の封止樹脂としてのモールド樹脂によって、上記半導体発光素子７ａを封止したランプ型半導体発光装置の断面図である。

【０１１３】この半導体発光装置は、基体としてのリードフレーム１０１の先端に、カップ形状の凹みであるマウント部１０ａを有する。このカップ形状のマウント部１０ａに、上記半導体発光素子７ａが例えばエポキシ樹脂等からなる接着剤１１で固定されている。上記半導体発光素子７ａの上面に設けられたＰ側電極６ａが、例えばＡｕ，Ａｌ，Ｃｕ等からなる金属ワイヤー６ｐによってリードフレーム１０１の電極部１０ｂに接続されている。また、上記半導体発光素子７ａの上面に設けられたＮ側電極５ａが、金属ワイヤー５ｎによって右側のリードフレーム１０２の電極部１０ｃに接続されている。そして、上記半導体発光素子７ａおよびリードフレーム１０１，１０２の上部を、蛍光体を分散させた例えば透光性のエポキシ樹脂等のモールド樹脂１３０によって封止して、ランプ形状の半導体発光装置を形成している。なお、上記半導体発光素子７ａとリードフレーム１０１のマウント部１０ａとを接合する接着剤１１は、半導体発光素子７ａからの光を吸収しない材料であれば特に限定されない。例えば、上記半導体発光素子７ａの熱特性改善のために熱伝導性の良い金属材料を混合した樹脂材料や、上記半導体発光素子７ａからリードフレーム１０１

31

のマウント部１０ａに向う光を効率よく反射・散乱させる材料を含有した樹脂材料等を用いてもよい。

【０１１４】図８（ｂ）は、導電性基板を有する半導体発光素子７ｂを備え、蛍光体を分散させたランプ形状の封止樹脂としてのモールド樹脂１３０によって上記半導体発光素子７ｂを封止したランプ型半導体発光装置の断面図である。図中、図８（ａ）に示した半導体発光装置と同一の機能を有する部分は、同一の参照番号を付して、詳細な説明を省く。

【０１１５】この半導体発光装置は、上記半導体発光素子７ｂのＮ側電極部５ｂが、リードフレーム１０１のマウント部１０ａに、例えばインジウム等の金属系からなる導電性のろう材またはＡｕ－エポキシ樹脂，Ａｇ－エポキシ樹脂等からなる接着剤１５によって直接接続されている。一方、上記半導体発光素子７ｂの上面に設けられたＰ側電極６ｂは、金属ワイヤー６ｐによって図８（ｂ）において右側のリードフレーム１０２の電極部１０ｃに接続されている。そして、上記半導体発光素子７ｂおよびリードフレーム１０１，１０２の上部が、蛍光体を分散させたモールド樹脂１３０によって封止されて、ランプ形状の半導体発光装置を形成している。半導体発光素子７ｂの上下に設けられた電極６ｂ，５ｂは、従来のＧａＡｓ系やＧａＰ系の半導体発光素子と同様であるので、従来の半導体発光装置に用いられたリードフレームをそのまま利用できる。

【０１１６】図８（ｃ）は、絶縁性基板を有する半導体発光素子７ｃを備え、この半導体発光素子７ｃとリードフレーム１０３，１０３とを金属ワイヤーを用いずに接続して、蛍光体を分散させたランプ形状の封止樹脂としてのモールド樹脂１３０によって上記半導体発光素子７ｃを封止したランプ型半導体発光装置の断面図である。

【０１１７】この半導体発光装置は、互いに対向して配置されたリードフレーム１０３，１０３の先端に、基体としてのサブマウント１７を連結している。このサブマウント１７はＳｉからなって絶縁性であり、サブマウント１７の上面には電極配線１７ａ，１７ｂが形成されている。このサブマウント１７の上面に、上記半導体発光素子７ｃが半導体層側面（図１（ｃ）における半導体発光素子７ｃの下側面）を対向させて搭載されている。上記半導体発光素子７ｃの下側面に設けられたＰ側電極６ｃとＮ側電極５ｃは、例えばＡｕバンプ等を用いて上記サブマウント１７の上面に形成された電極配線１７ａ，１７ｂに接続されている。上記サブマウント１７の上面に形成された電極配線１７ａ，１７ｂは、リードフレームの先端部１０ｄ，１０ｅに接続して、外部と電気的に接続している。そして、上記半導体発光素子７ｃおよびサブマウント１７と、リードフレーム１０３，１０３の上部を、蛍光体を分散させたエポキシ樹脂からなるモールド樹脂１３０によって封止して、ランプ形状の半導体発光装置を形成している。この半導体発光装置は、上記

32

半導体発光素子７ｃをサブマウント１７に直接接続しているので、上記半導体発光素子７ｃの発光領域からの熱をサブマウント１７とリードフレーム１０３，１０３を介して半導体発光装置の外部に素早く逃がすことができるという利点がある。

【０１１８】図８（ａ），（ｂ），（ｃ）に示したランプ形状の半導体発光装置は、放射される光が図８（ａ），（ｂ），（ｃ）の上方に向う指向性を有しており、特に図８（ａ），（ｂ）の半導体発光装置は、半導体発光素子７ａ，７ｂから出射された光を効率良く集光するために、リードフレーム１０１のマウント部１０ａがカップ形状に形成されている。上記モールド樹脂１３０は、エポキシ樹脂以外に例えばシリコン樹脂，ウレタン樹脂，ポリカーボネート樹脂等の透光性を有する熱硬化性，熱可塑性の樹脂を用いてもよい。また、上記蛍光体はモールド樹脂１３０全体に均一に分散させてもよいが、モールド樹脂１３０の表面から半導体発光素子７ａ，７ｂ，７ｃに向って漸次蛍光体の含有比率を高くすると、モールド樹脂１３０の外側からの水分等の影響による蛍光体の劣化を低減できる。また、半導体発光素子７ａ，７ｂ，７ｃからモールド樹脂１３０の表面に向って漸次蛍光体の含有比率を高くすると、半導体発光素子７ａ，７ｂ，７ｃによる蛍光体への電気的および熱的影響を緩和することもできる。このように、モールド樹脂１３０中の蛍光体の分布は、モールド樹脂の種類，蛍光体の種類，使用環境，条件または用途等に応じて、様々な形態をなすことができる。

【０１１９】（第２の実施形態）図９（ａ），（ｂ）は、本発明の第２の実施形態における半導体発光装置を示した断面図である。図９（ａ）の半導体発光装置は、リードフレーム１０１のマウント部１０ａ内に蛍光体を充填すると共に、モールド樹脂１３１が蛍光体を含まないこと以外は、図８（ａ）に示した半導体発光装置と同一である。図９（ｂ）の半導体発光装置についても、リードフレーム１０１のマウント部１０ａ内に蛍光体を充填すると共に、モールド樹脂１３１が蛍光体を含まないこと以外は、図８（ｂ）に示した半導体発光装置と同一である。したがって、図８（ａ），（ｂ）に示した半導体発光装置と同一の機能を有する部分には同一の参照番号を付して、詳細な説明を省略する。以下の他の実施形態においても同様である。

【０１２０】図９（ａ），（ｂ）に示した半導体発光装置は、半導体発光素子７ａ，７ｂを、カップ形状のマウント部１０ａの底に配置すると共に、このマウント部１０ａに蛍光体１２を充填して、この蛍光体１２によって半導体発光素子７ａ，７ｂからの光の波長を変換するようにしている。すなわち、半導体発光素子７ａ，７ｂからの光を集めるマウント部１０ａに上記蛍光体１２を配置することによって、半導体発光素子７ａ，７ｂからの光をもれなく変換させて、光の変換効率を高めているの

である。したがって、上記第１の実施形態におけるようなモールド樹脂全体に蛍光体を分散させる場合に比べて、半導体発光装置の色調が良く、しかも蛍光体はマウント部１０ａ内のみに配置すればよいので、蛍光体の使用量が低減される。

【０１２１】上記実施形態において、蛍光体１２はリードフレーム１０１のマウント部１０ａ内全体に充填したが、半導体発光素子７ａ，７ｂからの放出光を充分に所定の波長に変換できるのであれば、必ずしもマウント部１０ａ内全体に蛍光体１２を充填させる必要はなく、マウント部１０ａにおいて蛍光体１２を凹状に充填してもよい。あるいは、蛍光体１２を上記マウント部１０ａ上端よりも凸状に盛り上がるように充填してもよく、要は、半導体発光素子７ａ，７ｂからの光の波長を所望の波長に変換可能な量の蛍光体１２をマウント部１０ａに充填していればよい。

【０１２２】（第３の実施形態）図１０（ａ），（ｂ）は、本発明の第３の実施形態の半導体発光装置を示す断面図である。図１０（ａ）の半導体発光装置は、リードフレーム１０１のマウント部１０ａにおいて、半導体発光素子７ａ全体を覆うようにプレコーティング１３ａを配置して、その上に蛍光体１２を配置した以外は、図９（ａ）に示した半導体発光装置と同一である。図１０（ｂ）の半導体発光装置についても、リードフレーム１０１のマウント部１０ａにおいて、半導体発光素子７ａ全体を覆うようにプレコーティング１３ａを配置して、その上に蛍光体１２を配置した以外は、図９（ｂ）に示した半導体発光装置と同一である。したがって、図９（ａ），（ｂ）に示した半導体発光装置と同一の機能を有する部分には同一の参照番号を付して、詳細な説明を省略する。

【０１２３】図１０（ａ），（ｂ）において、左側リードフレーム１０１先端に形成されたカップ形状のマウント部１０ａの底に、半導体発光素子７ａ，７ｂを配置して、この半導体発光素子７ａ，７ｂ全体を覆うように例えばエポキシ樹脂，シリコン樹脂，ウレタン樹脂等からなるプレコーティング１３ａを形成している。このプレコーティング１３の上に、上記マウント部１０ａ内側を満たすように蛍光体１２を層状に配置している。上記蛍光体１２は、プレコーティング１３ａが形成されたマウント部１０ａをディッピングして、または、マウント部１０ａ内のプレコーティング１３ａ上にポッティング、あるいは噴霧，蒸着することによって、プレコーティング１３上に形成する。図１０（ａ），（ｂ）において、蛍光体１２はリードフレーム１０１のマウント部１０ａ内側にのみ形成したが、リードフレーム１０１の上面全てを覆うように形成してもよい。

【０１２４】図１０（ａ），（ｂ）に示す半導体発光装置は、上記蛍光体１２は、プレコーティング１３ａによって、半導体発光素子７ａ，７ｂの発光領域から略等距

離をおいて均一厚さに形成されている。したがって、蛍光体１２の全ての領域において通過する光量が略等しいので、この半導体発光装置はムラの無い均一な発光光が得られる。また、半導体発光素子７ａ，７ｂから離間した位置に蛍光体１２を配置するので、蛍光体１２に対する半導体発光素子の電気的および熱的影響を緩和できる。その結果、発光特性が良好で、しかも耐久性の良い半導体発光装置が得られる。

【０１２５】（第４の実施形態）図１１（ａ），（ｂ）は、本発明の第４の実施形態による半導体発光装置を示す断面図である。

【０１２６】図１１（ａ）は、絶縁性基板を有する半導体発光素子７ａを、基体としてのプリント配線基板１８上に搭載して、上記半導体発光素子７ａを、蛍光体を分散させた封止樹脂としてのモールド樹脂１３２によって封止している。

【０１２７】この半導体発光装置は、耐熱性を有するガラスエポキシからなる直方体形状のプリント配線基板１８上に、エポキシ樹脂からなる接着剤１１によって半導体発光素子７ａを接着している。この半導体発光素子７ａの上面に設けられたＰ側電極６ａとＮ側電極５ａは、金属ワイヤー６ｐ，５ｎによって、プリント配線基板１８上面の電極部１８ａ，１８ｂに各々接続されている。これらの電極部１８ａ，１８ｂは、プリント配線基板１８の上面と下面とを接続する図示しない断面円弧状のスルーホールを介して、実装面としてのプリント配線基板１８の下面に引き回されて、この実装面の両端部にまで延びている。なお、上記プリント配線基板１８は、絶縁性フィルムを用いてもよい。

【０１２８】そして、上記プリント配線基板１８上に、上記半導体発光素子７ａ全体を覆うように、蛍光体を分散させた封止樹脂としての例えば透光性のエポキシ樹脂等のモールド樹脂１３２を図１１（ａ）に示すような台形断面をなすように形成して、チップ部品形状の半導体発光装置を形成している。

【０１２９】上記半導体発光素子７ａとプリント配線基板１８とを接着する接着剤１１は、半導体発光素子７ａからの光が吸収されない材料であれば特に限定されない。例えば、半導体発光素子７ａの熱特性改善のために熱伝導性の良い金属材料を混合した樹脂材料や、半導体発光素子７ａからプリント配線基板１８に向って放出された光を効率よく反射・散乱させる材料を含有した樹脂材料等を用いてもよい。しかし、金属材料を含む樹脂材料を使用する場合は、Ｐ側電極６ａとＮ側電極５ａとが短絡しないように注意する必要がある。

【０１３０】図１１（ｂ）は、図１１（ａ）における半導体発光素子７ａに換えて、絶縁性基板を有する半導体発光素子７ｃを備える以外は、図１１（ａ）の半導体発光装置と同一である。したがって、図１１（ａ）と同様の機能を有する部分には同一の参照番号を付して、詳細

な説明を省略する。

【０１３１】図１１（ｂ）の半導体発光装置において、半導体発光素子７ｃは、半導体発光素子７ｃの図１１（ｂ）において上側に位置する絶縁性基板を通して光を出射する。上記半導体発光素子７ｃは、図１１（ｂ）において下側である半導体積層側に形成されたＰ側電極６ｃとＮ側電極５ｃを、Ａｕバンプを介してプリント配線基板１８上の電極部１８ａと１８ｂに各々直接接続している。なお、半導体発光素子７ｃを、予め金属配線が施されたＳｉからなるサブマウント等に搭載し、このサブマウントをプリント配線基板１８にダイボンドやワイヤーボンド等によって電気的に接続してもよい。この半導体発光装置は、半導体発光素子７ｃを、半導体積層側の面をプリント配線基板１８に向けて実装するので、上記半導体発光素子７ｃの発光領域からの熱を外部へ素早く逃がすことができる。

【０１３２】図１１（ａ），（ｂ）の半導体発光装置におけるモールド樹脂１３２は、エポキシ樹脂以外に例えばシリコン樹脂，ウレタン樹脂，ポリカーボネート樹脂等の透光性を有する熱硬化性，熱可塑性の樹脂を用いてもよい。また、蛍光体はモールド樹脂１３２全体に均一に分散させてもよいが、モールド樹脂１３２の表面から半導体発光素子に向って漸次蛍光体の含有比率を高くすると、水分等の影響による蛍光体の劣化を低減できる。また、半導体発光素子７ａ，７ｃからモールド樹脂１３２の表面に向って漸次蛍光体の含有比率を高くすると、蛍光体に対する半導体発光素子７ａ，７ｃの電気的および熱的影響を緩和することができる。このように、モールド樹脂１３２中の蛍光体の分布は、モールド樹脂の種類，蛍光体の種類，使用環境，条件，用途等に応じて様々な形態をなし得る。

【０１３３】なお、上記半導体発光素子７ａ，７ｃに換えて、導電性基板を有する半導体発光素子７ｂを使用してもよい。この場合は、プリント配線基板上の一方の電極に、半導体発光素子７ｂの下面に形成されたＮ型電極を、導電性を有する接着剤によって直接接続する。上記半導体発光素子７ｂの上面に設けられたＰ側電極は、金属ワイヤーによってプリント配線基板上の他方の電極部に接続する。上記半導体発光素子７ｂは、従来のＧａＡｓ系やＧａＰ系の半導体発光装置と同様に、半導体発光素子７ｂの上下両面に電極を有するので、従来のリードフレームをそのまま利用できるという利点がある。

【０１３４】（第５の実施形態）図１２（ａ），（ｂ）は、本発明の第５の実施形態の半導体発光装置を示す断面図である。図１２（ａ）の半導体発光装置は、基体としてのプリント配線基板１８上に、樹脂からなる枠１９を備える。このプリント配線基板１８上であって上記樹脂枠１９の内側に、導電性基板を有する半導体発光素子７ｂが配置されている。そして、上記樹脂枠１９の内側に、蛍光体を含む封止樹脂としてのモールド樹脂１３４

を充填して半導体発光素子７ｂを封止している。

【０１３５】この半導体発光装置は、耐熱性を有するガラスエポキシ等からなる直方体形状のプリント基板１８上に、樹脂からなる枠１９を設けている。この樹脂枠１９は、内側にモールド樹脂１３４を充填した際に半導体発光素子７ｂを樹脂１３４が十分に覆う程度の高さを有する。この枠１９の内側において、プリント配線基板１８上の一方の電極部１８ａと半導体発光素子７ｂ下面のＮ側電極５ｂとを、導電性を有する接着剤によって接着して接続している。一方、半導体発光素子７ｂの上面に設けられたＰ側電極６ｂは、金属ワイヤー６ｐによってプリント配線基板１８上の他方の電極部１８ｂに接続している。これら電極部１８ａ，１８ｂは、プリント配線基板１８を貫通する図示しない断面円弧状のスルーホールを介して、プリント配線基板１８の上面から実装面である下面まで立体的に引き回されて、プリント配線基板１８下面の両端にまで夫々延びている。上記プリント配線基板１８上かつ樹脂枠１９の内側に、半導体発光素子７ｂ全体を覆うように、蛍光体を分散させた透光性のエポキシ樹脂からなるモールド樹脂１３４が充填されている。上記半導体発光素子７ｂは、従来のＧａＡｓ系やＧａＰ系の半導体発光素子と同様に上下両面に電極６ｂ，５ｂを有するので、従来のリードフレームを共通で利用できるという利点がある。なお、基体としては上記プリント配線基板の他に絶縁性フィルムを用いてもよい。

【０１３６】図１２（ｂ）の半導体発光装置は、基体としてのプリント基板１８上に樹脂枠１９ａを備え、この樹脂枠１９ａの内側に、絶縁性基板を有する半導体発光素子７ｃを備えると共に蛍光体を分散させた封止樹脂としてのモールド樹脂１３４を充填している。上記樹脂枠１９ａは、半導体発光素子７ｃに面する側面が、半導体発光素子７ｃの側面から横方向に出射された光をプリント基板１８の直角方向に反射するように傾斜している。

【０１３７】この半導体発光装置は、ガラスエポキシからなる直方体形状のプリント基板１８上に、半導体発光素子７ｃに面する側面が傾斜した樹脂枠１９ａを備える。上記半導体発光素子７ｃは半導体積層側面を下に向けてプリント配線基板１８に搭載されている。半導体発光素子７ｃが備えるＰ側電極６ｃとＮ側電極５ｃは、プリント配線基板１８上の電極部１８ａと１８ｂに、Ａｕバンプを介して各々接続されている。上記電極部１８ａ，１８ｂは、図１２（ａ）に示した半導体発光装置と同様に、プリント配線基板１８の上面から図示しないスルーホールを介して下面まで立体的に引き回されて、プリント配線基板１８の下面両端にまで延長されている。なお、基体としては上記プリント配線基板１８の他に絶縁性フィルムを用いてもよい。また、上記半導体発光素子７ｃはプリント配線基板１８に直接接続したが、半導体発光素子７ｃを予め金属配線を施してＳｉからなるサブマウント等に搭載し、このサブマウントをプリント配

線基板１８にダイボンドやワイヤーボンド等によって電気的に接続してもよい。

【０１３８】この半導体発光装置は、半導体発光素子７ｃの半導体積層側面を直接プリント配線基板１８に実装しているので、半導体発光素子７ｃの発光領域からの熱をサブマウントおよびリードフレームを通して外部へ素早く逃がすことができるという利点がある。

【０１３９】図１２（ａ），（ｂ）の半導体発光装置におけるモールド樹脂１３４は、図８（ａ），（ｂ），（ｃ）のモールド樹脂１３と同様の材料であり、上記モールド樹脂中の蛍光体の分布は、モールド樹脂の種類，蛍光体の種類，使用環境，条件，用途等に応じて様々な形態を取り得る。

【０１４０】図１２（ａ），（ｂ）において、上記樹脂枠１９，１９ａはプリント配線基板１８と別に形成した後、プリント配線基板１８に張付けたが、厚めのプリント配線基板の一部を除去して凹部を形成して、この凹部の周りを枠にしてもよい。さらに、プリント配線基板に貫通穴を形成して、このプリント配線基板の底面に金属箔による電極兼配線を配置して、この電極兼配線の上に半導体発光素子を配置すると共に上記貫通穴部分を封止樹脂で封止してもよい。

【０１４１】また、図１２（ａ），（ｂ）の半導体発光装置において、半導体発光素子７ｂ，７ｃは、図１（ａ）に示した半導体発光素子７ａでもよく、この半導体発光素子７ａを用いた場合には、金属ワイヤーによって半導体発光素子７ａの電極とプリント配線基板の電極部とを接続する。

【０１４２】（第６の実施形態）図１３は、本発明の第６の実施形態における半導体発光装置を示す断面図である。

【０１４３】この半導体発光装置は、図１２（ｂ）に示した半導体発光装置が備える枠と同様の枠１９ａを有する。この枠１９ａは、ガラスエポキシからなる直方体状の基体としてのプリント基板１８上に設置されて、この枠１９ａの半導体発光素子７ｃに面した側面が、半導体発光素子７ｃの側面からの光をプリント基板１８の直角方向に反射するように傾斜している。上記半導体発光素子７ｃは半導体積層側を図１３において下側に向けて、図１３において上側の基板側から光を出射するようにプリント配線基板１８上に搭載されている。この半導体発光素子７ｃの電極６ｃ，５ｃは、図１２（ｂ）に示した半導体発光装置と同様に、バンプによってプリント配線基板１８の電極部１８ａ，１８ｂに接続されている。上記プリント配線基板１８上に配置された枠１９ａの内側には、エポキシ樹脂からなる透光性の封止樹脂としてのモールド樹脂１３５を充填して上記半導体発光素子７ｃを封止している。そして、上記枠１９ａおよびモールド樹脂１３の上に、蛍光体１２が所定の層厚を有して層状に形成されている。

【０１４４】この実施形態における半導体発光装置は、蛍光体１２は半導体発光素子７ｃの発光領域から略等距離の位置に均一の厚さで形成されているので、全ての蛍光体１２の位置において、蛍光体１２を通過する光量が略一定になって、ムラの無い均一な発光が可能である。また、上記蛍光体１２は、半導体発光素子７ｃから所定の距離をおいて形成されているので、蛍光体１２に対する半導体発光素子の電気的および熱的影響を緩和することができる。

【０１４５】上記実施形態では、蛍光体１２は樹脂枠１９ａの上面にも形成したが、樹脂枠１９ａが遮光性の材料で形成されていれば、蛍光体１２はモールド樹脂１３５の上のみに形成してもよい。また、樹脂枠１９ａの高さを高くして、モールド樹脂１３を半導体発光素子７ｃの上端を僅かに越える程度に充填した後、上記樹脂枠１９ａ内であって上記モールド樹脂１３５の上に、ポッティング等で蛍光体を配置してもよい。

【０１４６】上記樹脂枠１９ａは、図１２（ｂ）の半導体発光装置に関して述べた際と同様に、厚めのプリント配線基板１８の一部を除去して残った凸部を枠として使用してもよい。さらに、貫通穴を有するプリント配線基板の底部に、金属箔による電極兼配線を設けて凹部を形成しても良い。

【０１４７】また、外部への光取出し効率は落ちるが、半導体発光素子７ｃに面した側面が垂直に形成された樹脂枠を利用してもよい。

【０１４８】なお、上記半導体発光素子７ｃは、図１に示した半導体発光素子７ａ，７ｂを用いてもよい。特に、導電性基板を有する半導体発光素子７ｂは、上側および下側に電極を備え、従来のＧａＡｓ系やＧａＰ系の半導体発光素子と同様の電極構造であるので、従来のリードフレームをそのまま利用できるという利点がある。

【０１４９】（第７の実施形態）図１４（ａ），（ｂ）は、本発明の第７の実施形態における半導体発光装置を示す断面図である。

【０１５０】図１４（ａ）は、この半導体発光装置を発光方向から見た断面図であり、図１４（ｂ）は発光方向に対して直角方向から見た断面図である。

【０１５１】この半導体発光装置は、ガラスエポキシからなる直方体状の基体としてのプリント配線基板１８上に、エポキシ樹脂等の接着剤１１によって半導体発光素子７ａが接着されて、この半導体発光素子７ａの上面に設けられたＰ側電極６ａとＮ側電極５ａが、金属ワイヤー６ｐ，５ｎによってプリント配線基板１８の電極部１８ａ，１８ｂに各々接続されている。これらの電極部１８ａ，１８ｂは、プリント配線基板１８を貫通して形成された断面円弧状のスルーホール１９，１９を介してプリント配線基板１８の下面に立体的に引き回されて、このプリント配線基板１８の下面である実装面の両端まで延びている。なお、上記プリント配線基板１８に換えて

絶縁性フィルムを用いてもよい。

【０１５２】さらに、上記半導体発光素子７ａ全体を、蛍光体を分散させた透光性のエポキシ樹脂からなる封止樹脂としてのモールド樹脂１３６によって封止している。このモールド樹脂１３６は、図１４（ｂ）において左側縁と下側縁が直線をなす略４分の１楕円形状の断面を有する一方、図１４（ａ）において幅方向が高さ方向よりも長い矩形断面を有する。そして、上記モールド樹脂１３６の上に、上記半導体発光素子７ａからの光を反射するための反射体２０を形成している。

【０１５３】上記モールド樹脂１３６は、透光性を有し、かつ実装工程での半田リフローの際の高温にも耐え得る熱硬化性樹脂を用いるのが好ましく、プリント配線基板１８上に、樹脂ポッティング法やトランスファモールド法、インジェクションモールド法等によって形成する。上記モールド樹脂１３６の上面は、図１４（ｂ）に示すように放物線をなして湾曲するとともに、この放物線の中心線Ｉ－Ｉよりも上方に半導体発光素子７ａを配置している。また、上記モールド樹脂１３６の光の出射側面Ａは平坦に形成して、プリント配線基板１８の側面と略同一面にしている。なお、上記モールド樹脂１３６の曲面は、上記半導体発光素子７ａが曲面の放物線の中心線Ｉ－Ｉよりも下方に位置するように形成してもよい。

【０１５４】上記反射体２０は、半導体発光素子７ａの光及び蛍光体１２により波長変換された光を反射する材料を少なくとも含み、上記モールド樹脂１３６と同様に、半田リフローの際の高温にも耐え得る熱硬化性樹脂または熱可塑性樹脂を用いて、上記モールド樹脂１３６の上側面を覆うように樹脂ポッティング法やトランスファモールド法、インジェクションモールド法等によって形成する。この反射体２０は、図１４（ｂ）の断面に示すように、下側縁端がモールド樹脂１３６の上側縁端と接して湾曲する一方、左側縁端がモールド樹脂１３６の光出射面Ａと同一の平面をなすように、また、反射体２０の右側縁端が直線をなして上記プリント配線基板１８の右側端面に連続するように形成されている。そして、上記反射体の上端縁は上記プリント配線基板１８に平行に形成されている。この半導体発光装置は、モールド樹脂１３６の上面と反射体２０の下面との境界面が反射面となっている。この反射面で反射されて出射する光は、図１４（ａ）において水平方向左側に拡散される一方、上下方向には反射体２０およびプリント配線基板１８によって遮られる。したがって、半導体発光素子７ａからの直接光及び反射光は、水平方向に絞られた指向特性となる。具体的には、照射光における水平方向の半値角が±６５°、垂直方向の半値角が±３０°の指向特性を有する。したがって、半導体発光素子７ａからの光は、モールド樹脂１３６中の蛍光体１２により波長変換されて、直接出射すると共に反射体２０で反射されて、モールド樹脂１３６の側面部から外部へ出射するので、水平方向に有効照射領域が広く、かつ高輝度なサイド発光型半導体発光装置を提供できる。

【０１５５】なお、反射体２０は、モールド樹脂１３６と接する部分にのみ反射作用を有していればよいので、モールド樹脂１３６の湾曲した上側面、あるいは反射体２０の湾曲部した下側面のいずれかに、例えば金属や白色塗料等からなる反射層を設けるだけでもよい。

【０１５６】上記半導体発光素子７ａをプリント配線基板１８に接着する樹脂は、半導体発光素子７ａからの光が吸収されないものであれば特に限定無く利用可能である。例えば、半導体発光素子７ａの熱特性改善のために熱伝導性のよい金属を混合した樹脂や、リードフレームマウント部方向に放出された光を効率よく反射・散乱させる材料を含有した樹脂等を用いてもよい。しかし、金属を含む樹脂を使用する場合は、Ｐ側電極とＮ側電極とが短絡しないように注意する必要がある。

【０１５７】なお、この実施形態における半導体発光装置において、上記半導体発光素子７ａに換えて、図１（ｂ）に示した上面および下面に夫々電極を備える半導体発光素子７ｂや、図１（ｃ）に示した基板側から光を出射するタイプの半導体発光素子７ｃを用いてもよい。上記半導体発光素子７ｂは、従来のＧａＡｓ系やＧａＰ系の半導体発光装置と同一の電極構造を有するので、従来のリードフレームをそのまま利用できるという利点がある。上記半導体発光素子７ｃは、半導体積層側面を直接電気配線に実装するので、発光領域からの熱をサブマウント・リードフレームを通して外部へ速やかに逃がしてやる事ができるという利点がある。

【０１５８】（第８の実施形態）図１５（ａ），（ｂ）は、本発明の第８の実施形態としてのサイド発光型半導体発光装置を示す断面図である。

【０１５９】図１５（ａ）は、この半導体発光装置を発光方向から見た断面図を示し、図１５（ｂ）は発光方向に対して直角方向から見た断面図である。図１５（ａ），（ｂ）の半導体発光装置は、上面と下面に電極を有する半導体発光素子７ｂを使用したことと、蛍光体を封止樹脂中に分散させずに、封止樹脂としてのモールド樹脂１３７の光の出射面Ａ側に蛍光体１２を層状に設けたこと以外は、図１４（ａ），（ｂ）の半導体発光装置と同一であり、同一の機能を有する部分には同一の参照番号を付して詳細な説明を省略する。

【０１６０】このサイド発光型半導体発光装置は、蛍光体１２を半導体発光素子７ｂの発光領域から略等距離の位置に均一の層厚に形成したので、蛍光体１２の略全域において通過する光の量が常に一定となり、ムラの無い均一な発光が可能になる。また、半導体発光素子７ｂから離間した位置に蛍光体１２を配置したので、蛍光体１２に対する半導体発光素子７ｂの電流や熱による影響を緩和できる。また、上記半導体発光素子７ｂにおいて上

面と下面に電極６ｂ，５ｂを配置したタイプは、従来のＧａＡｓ系やＧａＰ系の半導体発光素子と電極構造が同一であるので、従来のリードフレームをそのまま利用できるという利点がある。

【０１６１】本発明の実施形態において、上記半導体発光素子７ｂは、図１（ａ）の半導体発光素子７ａおよび図１（ｃ）の半導体発光素子７ｃを使用してもよい。

【０１６２】（第９の実施形態）図１６（ａ），（ｂ）は、本発明の第９の実施形態であるサイド発光型半導体発光装置を示す図である。

【０１６３】図１６（ａ）はこの半導体発光装置を発光方向から見た断面図であり、（ｂ）は発光方向に対して直角方向から見た断面図である。この半導体発光装置は、基体としてのプリント配線基板１８上に、半導体発光素子７ｃを封止する封止樹脂としてのモールド樹脂１３９を備える。このモールド樹脂１３９は、図１６（ａ）において楕円の下半分が除去されたような形状である略半楕円形状の断面を有すると共に、図１６（ｂ）において楕円の左側と下方が除去されたような形状である略４分の１楕円形状の断面を有する。すなわち、上記モールド樹脂１３９は、プリント配線基板１８上において、光出射面Ａを除く面が所定の曲率半径を有するドーム形状をなす。そして、このモールド樹脂１３９の外側面の曲面部分を覆って蛍光体としての蛍光体層１２ａが形成されていて、さらにその外側面に半導体発光素子７ｃからの光を反射するための反射体２０が形成されている。

【０１６４】さらに、プリント配線基板１８上の半導体発光素子７ｃの光出射面Ａ側に、半導体発光素子７ｃからの光を直接外部へ出さないように遮断する遮蔽体としての障壁体２１が設けられている。この障壁体２１は、半導体発光装置９４の発光面Ａ側から見て（図１６（ａ）参照）、半導体発光素子７ｃの発光領域を遮る高さおよび幅を有し、半導体発光素子７ｃの光に対して不透明な樹脂や金属等が用いられる。また、障壁体２１の材料として光を吸収する材料を利用してもよいが、その場合、光の利用効率が悪くなる。また，図１６（ｂ）に破線で示すように、半導体発光素子７ｃの周りを囲む樹脂枠からなる障壁体２１ａを用いてもよい。また、上記半導体発光素子７ｃから直接出射される光を遮るために、厚めのプリント配線基板の一部に凹部を形成して、この凹部に発光領域が隠れるように半導体発光素子を配置してもよい。半導体発光素子７ｃは、半導体積層側を直接プリント配線基板１８に接続して搭載するので、発光領域からの熱をサブマウント・リードフレームを通して外部へ素早く逃がしてやる事ができると共に、半導体発光素子の発光領域が下方に位置するので障壁体の高さを低くすることができて、光の利用効率が大きい。なお、上述の遮蔽体２１，２１ａおよび凹部を、図１４（ａ），（ｂ）に示した第７の実施形態の半導体発光装置に用いることも可能である。

【０１６５】上記半導体発光素子７ｃからの出射光は上記蛍光体層１２ａで波長変換された後、この蛍光体層１２ａに接する反射体２０で反射されて、再び蛍光体層１２ａで波長変換された後に、半導体発光装置外部に出射される。したがって、単に半導体発光素子からの光が透過するように光の出射方向に配置された蛍光体を備える半導体発光装置に較べて、この半導体発光装置は略二倍の波長変換効率を有する。したがって、蛍光体層１２ａを薄くしても充分な波長変換効果が期待できるので、蛍光体の使用量を削減できて、半導体発光装置のコストを低減できる。

【０１６６】上記実施形態における蛍光体層１２ａは光を透過させて波長変換を行ったが、非透過であって、光を波長変換すると共に反射させる蛍光体を反射体として形成してもよい。例えば、光を反射・散乱させる性質をもった微細粒子の表面に蛍光材料を塗布した蛍光体等が考えられる。

【０１６７】なお、本実施形態において、半導体発光素子７ｃに換えて図１（ａ），（ｂ）に示す半導体発光素子７ａ，７ｂを用いてもよい。特に、導電性基板を有する半導体発光素子７（ｂ）は、上下両側面に電極を有する従来のＧａＡｓ系やＧａＰ系の半導体発光素子と同様の電極構造を有するので、従来のリードフレームをそのまま利用できる。

【０１６８】（第１０の実施形態）図１７（ａ），（ｂ）は、本発明の第１０の実施形態としてのサイド発光型半導体発光装置を示す断面図である。

【０１６９】図１７（ａ）は上記半導体発光装置を発光方向から見た断面図を示し、図１７（ｂ）は発光方向に対して直角方向から見た断面図である。本実施形態が、図１６（ａ），（ｂ）に示した第９の実施形態と異なる点は、半導体発光素子７ｃに換えて導電性基板を有する半導体発光素子７ｂを用いた点と、プリント配線基板１８に換えて、貫通穴Ｂを有するガラスエポキシ基板の底面に、金属箔からなり電極兼配線を備えた極薄型プリント配線基板２３を装着してなる基体としてのプリント配線基板１８ａを用いた点である。

【０１７０】図１７（ａ），（ｂ）に示すように、このサイド発光型半導体発光装置は、半導体発光素子７ｂを、プリント配線基板１８ａの貫通孔Ｂ内に没するように、上記極薄プリント配線基板２３の上に設置している。したがって、半導体発光素子７ｂの高さをプリント配線基板１８ａの厚さで吸収できるので、半導体発光装置の薄型化が可能になると共に、半導体発光素子７ｂの発光領域が外部から完全に隠れるので、半導体発光素子７ｂから出射される光が直接外部に出ない。すなわち、蛍光体としての蛍光体層１２ａによって波長が変換された光のみが半導体発光装置の外部に出射されるので、半導体発光装置の色調が、さらに良くなる。なお、上記貫

43

通孔Ｂの深さは、少なくとも半導体発光素子７ｂの発光領域が、光の出射面Ａ（図１７（ｂ）参照）側から見て隠れる程度であればよい。

【０１７１】なお、上記実施形態において、半導体発光素子７ｂは、図１（ａ），（ｃ）に示した半導体発光素子７ａ，７ｃを用いてもよい。特に、上記半導体発光素子７ｃは、貫通孔Ｂ内に配置した場合、貫通穴Ｂの底部近くに発光領域が位置するので、半導体発光装置を更に薄型にできる。

【０１７２】（第１１の実施形態）図１８（ａ），（ｂ），（ｃ）および図１９（ａ），（ｂ），（ｃ）は、本発明の第１１の実施形態の半導体発光装置が出射する光の波長分布を示した図である。この半導体発光装置は、基体上に半導体発光素子を備え、この半導体発光素子の出射光は、３９０ｎｍ乃至４２０ｎｍの波長領域のうちの４１０ｎｍに発光波長のピークを有する。さらに、この半導体発光装置は、上記半導体発光素子の出射光を変換する第１、第２、第３の蛍光体を備える。上記半導体発光素子は、この半導体発光素子によって損傷しない樹脂からなる封止樹脂で封止されていて、この封止樹脂に、上記第１、第２、第３の蛍光体が、略均一に混合された状態で含まれている。上記第１の蛍光体は、０．５MgF_2・３．５MgO・GeO_2：Ｍｎの蛍光体からなり、上記半導体発光素子の出射光によって励起されて、発光波長が６５８ｎｍに主ピークを有する赤色の光を出射する。上記第２の蛍光体は、$SrAl_2O_4$：Ｅｕの蛍光体からなり、発光波長が５２２ｎｍに主ピークを有する緑色の光を出射する。上記第３の蛍光体は、$BaMgAl_{10}O_{17}$：Ｅｕの蛍光体からなり、発光波長が４５２ｎｍに主ピークを有する青色の光を出射する。この半導体発光装置は、上記第１、第２、第３の蛍光体からの出射光を混色することによって白色の光を出射し、携帯電話や携帯情報端末，パーソナルコンピュータ等の表示装置のバックライト用光源として用いられる。なお、上記半導体発光素子の発光波長のピークは、３９０ｎｍ乃至４２０ｎｍの波長領域にあるが、４００ｎｍ乃至４２０ｎｍの波長領域にあれば、より好ましい。

【０１７３】図１８（ａ），（ｂ），（ｃ）は、上記半導体発光装置において、上記第１、第２、第３の蛍光体の混合比率を変えた場合、出射光の波長分布に生じる変化を示した図である。いずれも、横軸は波長（ｎｍ）であり、縦軸は相対強度（％）である。また、いずれにおいても、上記封止樹脂の重量に対する上記第１、第２、第３の蛍光体の総重量の比率は、０．５である。

【０１７４】図１８（ａ）は、第１、第２、第３の蛍光体の総量が１００重量％であるとして、第１の蛍光体が４７重量％、第２の蛍光体が１３重量％、第３の蛍光体が４０重量％である場合の半導体発光装置による出射光の波長分布を示した図である。この場合の半導体発光装置の出射光は、やや緑色がかった色調の白色になる。

44

【０１７５】図１８（ｂ）は、第１、第２、第３の蛍光体の総量が１００重量％であるとして、第１の蛍光体が５６重量％、第２の蛍光体が１１重量％、第３の蛍光体が３３重量％である場合の半導体発光装置による出射光の波長分布を示した図である。この場合の半導体発光装置の出射光は、良好な色調の白色になる。

【０１７６】図１８（ｃ）は、第１、第２、第３の蛍光体の総量が１００重量％であるとして、第１の蛍光体が６５重量％、第２の蛍光体が２６重量％、第３の蛍光体が９重量％である場合の半導体発光装置による出射光の波長分布を示した図である。この場合の半導体発光装置の出射光は、やや赤色がかった色調の白色、いわゆる、昼白色になる。

【０１７７】また、第１の蛍光体としてのLa_2O_2S：Ｅｕと、第２の蛍光体としての$BaMg_2Al_{16}O_{27}$：Ｅｕ，Ｍｎと、第３の蛍光体としての（Ｓｒ，Ｃａ，Ｍｇ，Ｃｅ）$_{10}(PO_4)_6Cl_2$：Ｅｕとを、順に７２重量％、７重量％、２１重量％の割合で備える半導体発光装置を形成した。この半導体発光装置の出射光は、良好な白色光であった。さらに、上記第１、第２、第３の蛍光体を、順に、５８重量％、２２重量％、２０重量％の割合で備える半導体発光装置もまた、良好な白色の出射光が得られた。以上の実験結果を考慮すると、上記半導体発光装置の発光色は、第１の蛍光体、すなわち、赤色発光の蛍光体の混合比率が５０重量％より少ないと、緑色がかった色調の白色になる一方、上記第１の蛍光体の混合比率が７０重量％より多いと、赤色がかった色調の白色になることが分かった。また、上記半導体発光装置の発光色は、第２の蛍光体、すなわち、緑色発光の蛍光体の混合比率が７重量％より少ないと、赤色がかった色調の白色になり、上記第２の蛍光体の混合比率が２０重量％より多いと、緑色がかった色調の白色になることが分かった。また、上記半導体発光装置の発光色は、第３の蛍光体、すなわち、青色発光の蛍光体の混合比率が２０重量％より少ないと、赤色がかった色調の白色になり、上記第３の蛍光体の混合比率が３０重量％より多いと、緑色がかった色調の白色になることが分かった。したがって、第１１の実施形態の半導体発光装置は、封止樹脂の重量に対する第１乃至第３の蛍光体の総重量の比率が０．５である場合、第１、第２、第３の蛍光体が、各々５６重量％、１１重量％、３３重量％の混合比率であると良好な白色の出射光が得られる。

【０１７８】図１９（ａ），（ｂ），（ｃ）は、上記半導体発光装置において、封止樹脂の重量に対する第１、第２、第３の蛍光体の総重量の比率を変えた場合、出射光の波長分布に生じる変化を示した図である。いずれも、横軸は波長（ｎｍ）であり、縦軸は相対強度（％）である。また、いずれにおいても、第１、第２、第３の蛍光体の総量が１００重量％であるとして、第１の蛍光

体が６５重量%、第２の蛍光体が２６重量%、第３の蛍光体が９重量%の混合比率である。

【０１７９】図１９（ａ）は、封止樹脂の重量に対する第１、第２、第３の蛍光体の総重量の比率が、０．５である場合の半導体発光装置による出射光の波長分布を示した図である。この半導体発光装置の出射光は、やや赤色がかった色調の白色、いわゆる、昼白色になる。

【０１８０】図１９（ｂ）は、封止樹脂の重量に対する第１、第２、第３の蛍光体の総重量の比率が、０．６６である場合の半導体発光装置による出射光の波長分布を示した図である。この半導体発光装置の出射光は、良好な色調の白色になる。

【０１８１】図１９（ｃ）は、封止樹脂の重量に対する第１、第２、第３の蛍光体の総重量の比率が、１．０である場合の半導体発光装置による出射光の波長分布を示した図である。この半導体発光装置の出射光は、やや緑色がかった色調の白色になる。

【０１８２】図１９（ａ），（ｂ），（ｃ）より、上記半導体発光装置は、上記第１、第２、第３の蛍光体が、各々６５重量%、２６重量%、９重量%であって、封止樹脂の重量に対する第１、第２、第３の蛍光体の総重量の比率が０．５以上１．０以下の場合に、良好な色調の白色の出射光が得られることが分かる。

【０１８３】図２０は、図１９（ａ）に示した半導体発光装置の発光スペクトル１５０と、人間の比視感度１５１を考慮した半導体発光装置の実効発光スペクトル１５２とを示す図である。横軸は波長（ｎｍ）であり、縦軸は相対強度（%）である。

【０１８４】図２０から分かるように、上記半導体発光装置の発光スペクトル１５０は、人間の比視感度１５１が有する波長領域より大きい発光波長領域を有するので、上記比視感度１５１の波長領域を網羅する波長領域の実効発光スペクトル１５２が得られるから、人間の視覚において、色調が良好な白色の発光色にできる。

【０１８５】さらに、上記半導体発光装置は、上記封止樹脂が半導体発光素子からの出射光によって損傷しない樹脂であるから、この封止樹脂は、例えば黒化などの不都合が生じない。したがって、半導体発光装置の輝度の低下などの不都合を防止でき、半導体発光装置の性能を長期に亘って安定にできる。

【０１８６】上記半導体発光装置において、上記第１、第２、第３の蛍光体に、各々複数種類の蛍光体を用いることによって、上記実効発光スペクトル１５２の波長領域を人間の比視感度１５１の波長領域範囲と略等しくしてもよい。これによって、半導体発光装置の発光色の色調を良好にできるとともに、半導体発光装置の発光波長領域を人間の可視領域のみにできるので、半導体発光装置の発光効率を向上できる。

【０１８７】本実施形態の半導体発光装置は、半導体発光素子を封止する封止樹脂に、上記第１、第２、第３の

蛍光体を略均一に混合したが、上記第１、第２、第３の蛍光体のみを混合し、この混合した蛍光体を、封止樹脂の表面に層状に配置してもよく、また、上記第１、第２、第３の蛍光体を、上記封止樹脂の表面に各々別個に層状に設けてもよい。この場合、光の発光・吸収波長などを考慮して、半導体発光素子に近い側から遠い側に向って、各々の層を、その層が含む蛍光体の発光波長が短い順に配置するのが好ましい。また、本実施形態の半導体装置は、上記第１乃至１０の実施形態の半導体発光装置と同様の構造に形成してもよい。これによって、ランプ型、チップ部品型、サイド発光型の半導体発光装置において、良好な色調の白色発光を得ることができる。

【０１８８】（第１２の実施形態）図２１は、本発明の第１２の実施形態の発光表示装置を示す模式図である。この発光表示装置２００は、上記第１１の実施形態の半導体発光装置からなる光源２０１と、光源２０１からの光２０５を導く導光板２０２と、この導光板２０２からの光を分光するカラーフィルタを備えた液晶パネル２０３とを有する液晶表示装置である。

【０１８９】上記光源２０１は、上記第１乃至１１の実施形態の半導体発光装置のいずれを用いて形成してもよい。特に、上記発光表示装置２００が、携帯電話や携帯情報端末，パーソナルコンピュータなどの表示装置として用いられる場合は、光源２０１として、上記第１１の実施形態の白色発光の半導体発光装置が好適である。また、上記第１１の実施形態の半導体発光装置が備える第１、第２、第３の蛍光体を、上記第４乃至６の実施形態の半導体発光装置の蛍光体として用いると、チップ部品形状を有して白色発光可能な半導体発光装置が得られる。この半導体発光装置は、チップ部品形状を有するので、発光表示装置２００に実装する際の取り扱いが容易になる。また、上記チップ部品形状を有する半導体発光装置は、上記導光板２０２の側面２０２ａに直接取り付けることができるので、発光光を効率良く導光板２０２に導くことができる。また、上記第７乃至１０の実施形態の半導体発光装置に、第１１の実施形態の蛍光体を搭載した半導体発光装置を用いて光源２０１を構成すると、この半導体発光装置はサイド発光型であるから、基体としてのプリント配線基板１８が導光板２０２に略平行になるように、導光板の側面２０２ａに半導体発光装置を取り付けることによって、この導光板２０２の光出射方向の発光表示装置２００の厚みを効果的に小さくできる。なお、上記光源２０１は、複数の半導体発光装置を用いたが、光の強度が十分であれば１個の半導体発光装置によって構成してもよい。

【０１９０】上記導光板２０２は、例えばポリカーボネートやアクリル系樹脂などから形成する。また、光源２０１からの光が導入される側面２０２ａと、導入した光を放出する光放出面２０２ｂ以外の面に光反射部を設けると、光源２０１からの光を効率良く光放出面２０２ｂ

から放出できる。また、導光板２０２への光は、１つの側面２０２ａのみからではなく、例えば対向する２つの側面から導入してもよく、あるいは、３つおよび４つの側面から導入してもよい。さらに、光放出面２０２ｂにおける放出光の強度を均一にするために、導光板２０２中に光散乱剤を混入したり、上記光放出面２０２ｂと対向する図２１における底側の面を傾斜させて、導光板の側面２０２ａから導入された光を上記傾斜させた底側面で反射させて光放出面２０２ｂから放出してもよい。上記底側面に光散乱パターンを設けると、光放出面２０２ｂからの光２０６の強度が、さらに均一にできる。

【０１９１】上記液晶パネル２０３は、透明電極を設けた２つの透明な基板と、この２つの基板間に封入された液晶と、偏光板と、上記基板に貼り付けられたカラーフィルタを備える。上記カラーフィルタには、上記透明電極に印加する信号によって上記液晶を透過する光量が調節される複数の画素に対応して、赤色、緑色、青色のカラーフィルタが形成されている。このカラーフィルタは、シート状に形成したポリカーボネートやポリエチレンテレフタレートなどに、微小なハニカム形状あるいはデルタ配列形状の画素をなすように、光透過性の染料または顔料などで、赤色，緑色，青色に着色して、赤色、緑色、青色のカラーフィルタが形成されている。

【０１９２】図２２は、上記カラーフィルタの分光特性を示した図であり、２１０が赤色のカラーフィルタの分光特性であり、２１１が緑色のカラーフィルタの分光特性であり、２１２は青色のカラーフィルタの分光特性である。このカラーフィルタの分光特性２１０，２１１，２１２に適合するように、上記光源２０１からの光の波長分布が調節されている。より詳しくは、光源２０１を構成する半導体発光装置において、半導体発光素子の発光波長や、第１、第２、第２の蛍光体の発光波長および混合比率や、第１乃至３の蛍光体の総重量と封止用樹脂の重量との配合比率などを調節して、光源２０１からの光２０５の波長分布を、上記カラーフィルタの分光特性２１０，２１１，２１２に適合させている。例えば、良好な色調を有して図１９（ｂ）の波長分布をなす半導体発光装置は、図２２の分光特性に適合している。この半導体発光装置は、上記分光特性に適合するように、上記第１乃至３の蛍光体の総重量と封止用樹脂の重量との配合比率が調節されているからである。このように、上記光源２０１は上記カラーフィルタの分光特性に適合する波長分布を有するから、この光源２０１からの光２０５は、上記導光板２０２を介して液晶パネル２０３に導かれると、この液晶パネル２０３のカラーフィルタによって、輝度が高くて略単一の赤色、緑色、青色の光２０７に分光される。その結果、この発光表示装置２００は、色調が良好な、しかも、高輝度かつ高コントラストの画像や映像が表示できる。

【０１９３】

【発明の効果】以上より明らかなように、本発明の半導体発光装置は、上記半導体発光素子は発光波長が３９０ｎｍ乃至４２０ｎｍで人間の視感度が非常に低い短波長領域の出射光を有すると共に、この半導体発光素子からの出射光を６００ｎｍ乃至６７０ｎｍの赤色の発光波長に変換する蛍光体を備えるので、この蛍光体からの光は、人間の視感度を考慮すると、見かけ上、上記半導体発光素子からの直接光によって色調が殆ど変わらないから、この半導体発光装置は色調が良好で単色赤色の光を発光できる。また、上記半導体発光素子の発光波長は３９０ｎｍ乃至４２０ｎｍであるので、上記半導体発光装置を構成する部品の損傷や、人体への悪影響を効果的に防止できる。

【０１９４】１実施形態の半導体発光装置は、上記蛍光体は、M_2O_2S：Ｅｕ（但し、ＭはＬａ，Ｇｄ，Ｙから選ばれるいずれか一つまたは２以上の元素）、０．５ＭｇF_2・３．５ＭｇＯ・ＧｅO_2：Ｍｎ、Y_2O_3：Ｅｕ、Ｙ（Ｐ，Ｖ）O_4：Ｅｕ、ＹＶO_4：Ｅｕ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなるので、上記半導体発光素子の発光波長に応じて最適な蛍光体を選択できて、良好な色調の単色赤色発光の半導体発光装置を得ることができ、複数の蛍光体を組合わせて、半導体発光素子の光の利用効率が高い半導体発光装置にできる。

【０１９５】本発明の半導体発光装置は、上記半導体発光素子は発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有すると共に、この半導体発光素子からの出射光を５００ｎｍ乃至５４０ｎｍの緑色の発光波長に変換する蛍光体を備えるので、この蛍光体からの光は、人間の視感度を考慮すると、見かけ上、上記半導体発光素子からの直接光によって色調が殆ど変わらないから、この半導体発光装置は色調が良好で単色緑色の光を発光できる。また、上記半導体発光素子の発光波長は３９０ｎｍ乃至４２０ｎｍであるので、上記半導体発光装置を構成する部品の損傷や、人体への悪影響を効果的に防止できる。

【０１９６】１実施形態の半導体発光装置は、上記蛍光体は、$RMg_2Al_{16}O_{27}$：Ｅｕ，Ｍｎ（但し、ＲはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、$RMgAl_{10}O_{17}$：Ｅｕ，Ｍｎ（但し、ＲはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、ＺｎＳ：Ｃｕ、$SrAl_2O_4$：Ｅｕ、$SrAl_2O_4$：Ｅｕ，Ｄｙ、ＺｎＯ：Ｚｎ、$Zn_2Ge_2O_4$：Ｍｎ、Zn_2SiO_4：Ｍｎ、$Q_3MgSi_2O_8$：Ｅｕ，Ｍｎ（但し、ＱはＳｒ，Ｂａ，Ｃａから選ばれるいずれか一つまたは２以上の元素）、で表される蛍光体の群のうち、いずれか一つまたは２以上からなるので、上記半導体発光素子の発光波長に応じて最適な蛍光体を選択できて、緑色の単色発光の半導体発光装置を得ることができ、複数の蛍光体を組合わせて、半導体発光素子の光の利用効率が高い半導体発光装置にできる。

49

【０１９７】本発明の半導体発光装置は、上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有すると共に、この半導体発光素子からの出射光を４１０ｎｍ乃至４８０ｎｍの青色の発光波長に変換する蛍光体を備えるので、この蛍光体からの光は、人間の視感度を考慮すると、見かけ上、上記半導体発光素子からの直接光によって色調が殆ど変わらないから、この半導体発光装置は色調が良好で単色青色の光を発光できる。また、上記半導体発光素子の発光波長は３９０ｎｍ乃至４２０ｎｍであるので、上記半導体発光装置を構成する部品の損傷や、人体への悪影響を効果的に防止できる。

【０１９８】１実施形態の半導体発光装置は、上記蛍光体は、$A_{10}(PO_4)_6Cl_2$：Ｅｕ（但し、Ａは Ｓｒ，Ｃａ，Ｂａ，Ｍｇ，Ｃｅから選ばれるいずれか一つまたは２以上の元素）、$XMg_2Al_{16}O_{27}$：Ｅｕ（但し、ＸはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、$XMgAl_{10}O_{17}$：Ｅｕ（但し、ＸはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、ＺｎＳ：Ａｇ、$Sr_{10}(PO_4)_6Cl_2$：Ｅｕ、$Ca_{10}(PO_4)_6F_2$：Ｓｂ、$Z_3MgSi_2O_8$：Ｅｕ（但し、ＺはＳｒ，Ｂａ，Ｃａから選ばれるいずれか一つまたは２以上の元素）、ＳｒＭｇＳｉ$_2$Ｏ$_8$：Ｅｕ、$Sr_2P_2O_7$：Ｅｕ、$CaAl_2O_4$：Ｅｕ，Ｎｄ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなるので、上記半導体発光素子の発光波長に応じて最適な蛍光体を選択できて、青色の単色発光の半導体発光装置を得ることができ、複数の蛍光体を組合わせて、半導体発光素子の光の利用効率が高い半導体発光装置にできる。

【０１９９】本発明の半導体発光装置は、上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有すると共に、この半導体発光素子からの出射光を４８０ｎｍ乃至５００ｎｍの青緑色の発光波長に変換する蛍光体を備えるので、この蛍光体からの光は、人間の視感度を考慮すると、見かけ上、上記半導体発光素子からの直接光によって色調が殆ど変わらないから、この半導体発光装置は色調が良好で単色青緑色の光を発光できる。また、上記半導体発光素子の発光波長は３９０ｎｍ乃至４２０ｎｍであるので、上記半導体発光装置を構成する部品の損傷や、人体への悪影響を効果的に防止できる。

【０２００】１実施形態の半導体発光装置は、上記蛍光体は、$Sr_4Al_{14}O_{25}$：Ｅｕ、$Sr_4Al_{14}O_{25}$：Ｅｕ，Ｄｙ、$L_{10}(PO_4)_6Cl_2$：Ｅｕ（但し、ＬはＢａ，Ｃａ，Ｍｇから選ばれるいずれか一つまたは２以上の元素）、$Sr_2Si_3O_8 \cdot 2SrCl_2$：Ｅｕ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなるので、上記半導体発光素子の発光波長に応じて最適な蛍光体を選択できて、良好な色調の青緑色単色発光の半導体発光装置を得ることができ、複数の蛍光体を組合わせて、半導体発光素子の光の利用効率が高い半導体発光装置を得ることができる。

50

【０２０１】本発明の半導体発光装置は、上記半導体発光素子は、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有すると共に、この半導体発光素子からの出射光を５７０ｎｍ乃至６００ｎｍの橙色の発光波長に変換する蛍光体を備えるので、この蛍光体からの光は、人間の視感度を考慮すると、見かけ上、上記半導体発光素子からの直接光によって色調が殆ど変わらないから、この半導体発光装置は色調が良好で単色橙色の光を発光できる。また、上記半導体発光素子の発光波長は３９０ｎｍ乃至４２０ｎｍであるので、上記半導体発光装置を構成する部品の損傷や、人体への悪影響を効果的に防止できる。

【０２０２】１実施形態の半導体発光装置は、上記蛍光体は、ＺｎＳ：Ｍｎ、ＺｎＳ：Ｃｕ，Ｍｎ，Ｃｏ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなるので、上記半導体発光素子の発光波長に応じて最適な蛍光体を選択することができて、橙色の単色発光の半導体発光装置を得ることができる。

【０２０３】１実施形態の半導体発光装置は、半導体発光素子を搭載する基体の少なくとも一部と、上記半導体発光素子とを封止する封止樹脂が蛍光体を含んでいるので、半導体発光素子からの出射光を確実に波長変換できて、高効率の半導体発光装置にできる。また、封止樹脂を形成すれば蛍光体を配置できるから、蛍光体を別個に配置する必要がなくて、半導体発光装置の製造を容易にできる。

【０２０４】また、上記半導体発光装置は、発光波長が一定の波長領域を有する半導体発光素子と、所定の発光波長を有する蛍光体とを組み合わせることによって所望の発光波長を得るので、同一の製造工程で蛍光体を変えることのみによって、所望の発光波長の半導体発光発光装置を得ることができるから、半導体発光装置の製造コストを大幅に削減できる。

【０２０５】１実施形態の半導体発光装置は、半導体発光素子を、リードフレームの先端に形成されたカップ形状のマウント部の底に配置すると共に、もう一つのリードフレームに電気的に接続して、上記２つのリードフレームの少なくとも一部と上記半導体発光素子とを上記封止樹脂で封止しているので、上記カップ形状のマウント部で集められた半導体発光素子からの出射光が、上記封止樹脂が含む蛍光体によって確実に波長変換されるから、指向性が良く、かつ、発光効率が良くて色調の良い半導体発光装置を得ることができる。

【０２０６】１実施形態の半導体発光装置は、上記半導体発光素子を、一対のリードフレームの先端に連結された絶縁体の金属配線に直接接続して、上記一対のリードフレームの少なくとも一部と、上記絶縁体と、上記半導体発光素子とを上記封止樹脂で封止しているので、半導体発光素子をワイヤーボンディング等で金属配線に接続するよりも容易に半導体発光装置を製造できる。

【０２０７】１実施形態の半導体発光装置は、半導体発光素子を、リードフレームの先端に形成されたカップ形状のマウント部の底に配置すると共に、もう一つのリードフレームに電気的に接続して、上記カップ形状のマウント部に蛍光体を充填して、上記リードフレームの少なくとも一部と、上記半導体発光素子と、上記蛍光体とを封止樹脂で封止するので、半導体発光素子からの光を確実に波長変換できて高効率の半導体発光装置にすることができると共に、上記蛍光体の使用量を、上記実施形態におけるように封止樹脂に蛍光体を含有させるよりも少なくできる。

【０２０８】１実施形態の半導体発光装置は、半導体発光素子を、リードフレームの先端に形成されたカップ形状のマウント部の底に配置すると共に、もう一つのリードフレームに電気的に接続して、上記カップ形状のマウント部にコーティング部材を充填し、さらに上記コーティング部材の上に蛍光体を配置して、上記２つのリードフレームの少なくとも一部と、上記半導体発光素子と、上記コーティング部材と、上記蛍光体とを封止樹脂で封止するので、上記マウント部内の全てに蛍光体を充填する場合よりも蛍光体の使用量を少なくできる。また、上記コーティング部材によって上記半導体発光素子の発光部と蛍光体との間の距離を略均一にできるので、半導体発光装置の光を色むらが無く均一にできる。さらに、上記コーティング部材は上記半導体発光素子と蛍光体とを離間するので、半導体発光素子による蛍光体の電気的および熱的劣化を防止できる。

【０２０９】１実施形態の半導体発光装置は、半導体発光素子を基板の金属配線に接続して搭載し、上記半導体発光素子を、蛍光体を含んだ封止樹脂によって封止するので、上記半導体発光素子の種類を変えないで、上記封止樹脂に含まれる蛍光体の種類を変えるのみで所望の発光波長の半導体発光装置が得られるから、複数の所望の半導体発光装置が従来よりも容易に製造できて、その結果、半導体発光装置が低コストに製造できる。

【０２１０】１実施形態の半導体発光装置は、半導体発光素子が基板の金属配線に電気的に接続されていると共に基板の凹部内に配置されており、蛍光体が上記凹部に充填されているので、上記蛍光体の使用量を少量にできて製造コストを安価にでき、しかも、半導体発光素子からの光は確実に上記蛍光体で波長変換されるから、発光効率が良い半導体発光装置が得られる。

【０２１１】１実施形態の半導体発光装置は、上記凹部は、上記基板に配置された枠によって形成されているので、基板を例えば切削して凹部を形成する加工の手間が削減できる。また、上記枠の半導体発光素子側の面を、上記半導体発光素子からの出射光を集光する形状に加工すると、上記出射光の波長の変換効率をさらに向上できる。

【０２１２】１実施形態の半導体発光装置は、半導体発光素子が基板の金属配線に電気的に接続されていると共に基板の凹部内に配置されており、この凹部に封止樹脂を充填していると共に、上記封止樹脂の上に蛍光体を配置しているので、上記実施形態のように基板の凹部の内側に蛍光体を充填するよりも、上記蛍光体の使用量を削減できる。また、上記封止樹脂は、半導体発光素子の発光部と蛍光体との間の距離を略均一にするので、色むらが殆ど無い均一の発光を得ることができる。また、上記封止樹脂は、上位半導体発光素子と蛍光体とを離間させるので、上記蛍光体に対する半導体発光素子の電気的および熱的影響を低減して、半導体発光装置の性能を安定にできる。

【０２１３】１実施形態の半導体発光装置は、半導体発光素子が基板の金属配線に接続されて、上記半導体発光素子からの出射光の少なくとも一部を反射する反射体を備え、上記半導体発光素子を封止すると共に上記反射体からの反射光が透過する封止樹脂を備え、蛍光体が上記封止樹脂に含まれているので、上記半導体発光素子の種類を変えないで、上記蛍光体の種類を変えることのみによって所望の発光波長の半導体発光装置が得られるから、従来よりも容易に、しかも安価に半導体発光装置が製造できる。また、上記半導体発光素子からの出射光と、上記反射体によって反射された反射光とが確実に波長変換されるから、光の利用効率が良い半導体発光装置を得ることができる。

【０２１４】１実施形態の半導体発光装置は、半導体発光素子は基板の金属配線と電気的に接続されており、上記半導体発光素子からの出射光の少なくとも一部を反射する反射体を備えると共に、上記半導体発光素子から半導体発光装置の外部に直接出射する光を遮る遮蔽体を備え、上記半導体発光素子を封止すると共に上記反射体からの反射光が透過する封止樹脂を備え、蛍光体の層が、上記反射体において光が反射する面に設けられているので、半導体発光素子からの光は必ず上記反射体で反射されると共に波長変換されて、半導体発光装置の外部に出射するから、蛍光体を反射面のみに設ければよいので蛍光体の使用量が削減できて、安価に効率が良い半導体発光装置が得られる。さらに、上記蛍光体の層は、半導体発光素子から所定の距離をなす反射体の反射面に形成されて、半導体発光素子から略均一の距離をおいて配置されるので、色むらの無い均一発光の半導体発光装置にできる。さらに、半導体発光素子と蛍光体とが離間されるので、この蛍光体に対する半導体発光素子の電気的および熱的影響が緩和されて、安定した性能を有する半導体発光装置にできる。

【０２１５】１実施形態の半導体発光装置は、半導体発光素子は基板の金属配線と電気的に接続されており、上記半導体発光素子からの出射光の少なくとも一部を反射する反射体を備えると共に、上記半導体発光素子の発光部分が上記基板の凹部内に配置されていて、上記半導体

発光素子を封止すると共に上記反射体からの反射光が透過する封止樹脂を備え、蛍光体の層が、上記反射体において光が反射する面に設けられているので、上記半導体発光素子からの光は半導体発光装置の外部へ直接出射されずに、必ず上記反射体で反射されると共に波長変換されてから半導体発光装置の外部に出射されるから、色調が良好な出射光を有する半導体発光装置にできる。

【０２１６】１実施形態の半導体発光装置は、半導体発光素子は基板の金属配線と電気的に接続されており、上記半導体発光素子からの出射光の少なくとも一部を反射する反射体を備え、上記半導体発光素子を封止すると共に上記反射体からの反射光が透過する封止樹脂を備え、蛍光体の層が、上記封止樹脂の光が出射する面に設けられているので、半導体発光装置から出射される光は必ず波長変換されて、光の利用効率の良い半導体発光装置にできる。また、上記蛍光体の層は、半導体発光素子から略均一の距離をおいて配置されるので、色むらの無い均一発光の半導体発光装置にできると共に、上記蛍光体に対する半導体発光素子の電気的および熱的影響を緩和できて、安定した性能を有する半導体発光装置にできる。

【０２１７】本発明の半導体発光装置は、基体上に、発光波長が３９０ｎｍ乃至４２０ｎｍの出射光を有する半導体発光素子を搭載し、発光波長が６００ｎｍ乃至６７０ｎｍの波長領域に主発光ピークを有する赤色の出射光を有する第１の蛍光体と、発光波長が５００ｎｍ乃至５４０ｎｍの波長領域に主発光ピークを有する緑色の出射光を有する第２の蛍光体と、発光波長が４１０ｎｍ乃至４８０ｎｍの波長領域に主発光ピークを有する青色の出射光を有する第３の蛍光体とを備え、上記第１、第２、第３の蛍光体からの出射光の色の和が白色系であるので、上記半導体発光素子は人間の視感度が非常に低い短波長領域の発光波長を有する上に、上記各々の蛍光体が出射する光は、各々、赤色，緑色，青色の単色の光であるから、上記各々の蛍光体からの出射光が上記半導体発光素子からの直接の出射光によって色調が変化することなく、良好な色調の白色系の発光色を得ることができる。また、上記半導体発光素子から半導体発光装置外部に直接出射される光は、人間の可視領域において、蛍光体からの光と混色されていないから、経年変化によって半導体発光素子の発光性能が低下しても、半導体発光装置の輝度が低下するのみで、色調が変化することが防止できる。また、上記半導体発光素子の発光波長は３９０ｎｍ乃至４２０ｎｍであるので、上記半導体発光装置を構成する部品の損傷や、人体への悪影響を効果的に防止できる。

【０２１８】１実施形態の半導体発光装置は、上記第１の蛍光体は、M_2O_2S：Ｅｕ（但し、ＭはＬａ，Ｇｄ，Ｙから選ばれるいずれか一つまたは２以上の元素）、$0.5MgF_2 \cdot 3.5MgO \cdot GeO_2$：Ｍｎ、$Y_2O_3$：Ｅｕ、Ｙ（Ｐ，Ｖ）$O_4$：Ｅｕ、ＹＶＯ$_4$：Ｅｕ、

で表される蛍光体の群のうち、いずれか一つまたは２以上からなり、上記第２の蛍光体は、$RMg_2Al_{16}O_{27}$：Ｅｕ，Ｍｎ（但し、ＲはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、$RMgAl_{10}O_{17}$：Ｅｕ，Ｍｎ（但し、ＲはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、ＺｎＳ：Ｃｕ、$SrAl_2O_4$：Ｅｕ、$SrAl_2O_4$：Ｅｕ，Ｄｙ、ＺｎＯ：Ｚｎ、Zn_2GeO_4：Ｍｎ、Zn_2SiO_4：Ｍｎ、$Q_3MgSi_2O_8$：Ｅｕ，Ｍｎ（但し、ＱはＳｒ，Ｂａ，Ｃａから選ばれるいずれか一つまたは２以上の元素）、で表される蛍光体の群のうち、いずれか一つまたは２以上からなり、上記第３の蛍光体は、$A_{10}(PO_4)_6Cl_2$：Ｅｕ（但し、ＡはＳｒ，Ｃａ，Ｂａ，Ｍｇ，Ｃｅから選ばれるいずれか一つまたは２以上の元素）、$XMg_2Al_{16}O_{27}$：Ｅｕ（但し、ＸはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、$XMgAl_{10}O_{17}$：Ｅｕ（但し、ＸはＳｒ，Ｂａから選ばれるいずれか一つまたは両方の元素）、ＺｎＳ：Ａｇ、$Sr_{10}(PO_4)_6Cl_2$：Ｅｕ、$Ca_{10}(PO_4)_6F_2$：Ｓｂ、$Z_3MgSi_2O_8$：Ｅｕ（但し、ＺはＳｒ，Ｂａ，Ｃａから選ばれるいずれか一つまたは２以上の元素）、$SrMgSi_2O_8$：Ｅｕ、$Sr_2P_2O_7$：Ｅｕ、$CaAl_2O_4$：Ｅｕ，Ｎｄ、で表される蛍光体の群のうち、いずれか一つまたは２以上からなるので、発光波長が３９０ｎｍ乃至４２０ｎｍのうちのいずれの発光波長を有する半導体発光素子を用いても、この半導体発光素子の発光波長に対応して上記複数の蛍光体から適切な蛍光体を選択することによって、単色の赤色、および、緑色、および、青色の発光光が各々得ることができるから、これらの単色の赤色、緑色、青色の光の混色によって、良好な色調の白色系の光を得ることができる。また、上記蛍光体を複数の蛍光体を組合わせて形成することによって、半導体発光素子の発光波長の略全ての波長の光を、赤色、緑色、青色の波長に各々変換することができるので、半導体発光素子の出射光の利用効率を向上できて、高効率な白色系の発光色を有する半導体発光装置にできる。

【０２１９】１実施形態の半導体発光装置は、上記第１、第２、第３の蛍光体は、総量が１００重量％であるとして、上記第１の蛍光体が５０重量％以上７０重量％以下、上記第２の蛍光体が７重量％以上２０重量％以下、上記第３の蛍光体が２０重量％以上３０重量％以下であるので、上記第２の蛍光体が出射する緑色の光に比べて人間の視感度が低い第１および第３の蛍光体の出射光、すなわち、青色および赤色の光の強度を強めるから、人間の視感度を考慮して、良好な色調の白色系の発光色を有する半導体発光装置にできる。

【０２２０】１実施形態の半導体発光装置は、上記封止樹脂は、上記第１、第２、第３の蛍光体を含んでおり、上記封止樹脂の重量に対する上記第１、第２、第３の蛍

55

光体の総重量の比率が、０．５以上１以下であるので、自然光に近い白色系の発光色を有する半導体発光装置にできる。

【０２２１】１実施形態の発光表示装置は、上記半導体発光装置を用いた光源と、上記光源からの光を導く導光板と、上記導光板からの光を透過させて分光する赤、緑、青のカラーフィルタとを備え、上記半導体発光装置の出射光は、上記カラーフィルタの分光特性に適合した波長分布を有するので、上記半導体発光装置の出射光は、赤、緑、青の単色で、かつ、比較的大きい強度の光に分光できるから、光の利用効率が良好で高輝度の発光表示装置にできる。

【０２２２】１実施形態の発光表示装置は、半導体発光装置の出射光の波長分布が上記カラーフィルタの分光特性に適合するように、上記半導体発光素子の発光波長と、上記第１の蛍光体の発光波長と、上記第２の蛍光体の発光波長と、上記第３の蛍光体の発光波長と、上記第１、第２、第３の蛍光体の混合比率と、上記封止樹脂の重量に対する上記第１、第２、第３の蛍光体の総重量の比率とのうちの少なくとも一つを調節したので、上記半導体発光装置からの光を、上記カラーフィルタによって、確実に赤、緑、青の単色かつ比較的高い強度の光に分光できるから、上記発光表示装置は、色抜けなどが無くて高輝度かつ高コントラストのフルカラー表示ができる。

【０２２３】１実施形態の発光表示装置は、上記発光表示装置は、液晶表示装置であるので、色抜けが殆ど無く、高輝度かつ高コントラストの液晶表示装置が得られる。

【図面の簡単な説明】

【図１】　図１（ａ），（ｂ），（ｃ）は、本発明において用いられる半導体発光素子の断面図である。

【図２】　図２（ａ）は、赤色の発光色について、蛍光体の発光スペクトルを示す図であり、図２（ｂ）は蛍光体の励起スペクトルを示す図である。

【図３】　図３（ａ）は、赤色の発光色について、図２と異なる蛍光体の発光スペクトルを示す図であり、図３（ｂ）は蛍光体の励起スペクトルを示す図である。

【図４】　図４（ａ）は、緑色の発光色について、蛍光体の発光スペクトルを示す図であり、図４（ｂ）は蛍光体の励起スペクトルを示す図である。

【図５】　図５（ａ）は、緑色の発光色について、図４と異なる蛍光体の発光スペクトルを示す図であり、図５（ｂ）は蛍光体の励起スペクトルを示す図である。

【図６】　図６（ａ）は、青色の発光色について、蛍光体の発光スペクトルを示す図であり、図６（ｂ）は蛍光体の励起スペクトルを示す図である。

【図７】　図７（ａ）は、青色の発光色について、図６と異なる蛍光体の発光スペクトルを示す図であり、図７（ｂ）は蛍光体の励起スペクトルを示す図である。

56

【図８】　図８（ａ），（ｂ），（ｃ）は、本発明の第１の実施形態における半導体発光装置を示す断面図である。

【図９】　図９（ａ），（ｂ）は、本発明の第２の実施形態における半導体発光装置を示す断面図である。

【図１０】　図１０（ａ），（ｂ）は、本発明の第３の実施形態における半導体発光装置を示す断面図である。

【図１１】　図１１（ａ），（ｂ）は、本発明の第４の実施形態における半導体発光装置を示す断面図である。

【図１２】　図１２（ａ），（ｂ）は、本発明の第５の実施形態における半導体発光装置を示す断面図である。

【図１３】　本発明の第６の実施形態における半導体発光装置を示す断面図である。

【図１４】　図１４（ａ）は、本発明の第７の実施形態における半導体発光装置の正面から見た断面図であり、図１４（ｂ）は側面から見た断面図である。

【図１５】　図１５（ａ）は、本発明の第８の実施形態における半導体発光装置の正面から見た断面図であり、図１５（ｂ）は側面から見た断面図である。

【図１６】　図１６（ａ）は、本発明の第９の実施形態における半導体発光装置の正面から見た断面図であり、図１６（ｂ）は側面から見た断面図である。

【図１７】　図１７（ａ）は、本発明の第１０の実施形態における半導体発光装置の正面から見た断面図であり、図１７（ｂ）は側面から見た断面図である。

【図１８】　図１８（ａ）は第１の蛍光体が４７重量％、第２の蛍光体が１３重量％、第３の蛍光体が４０重量％である場合、図１８（ｂ）は、第１の蛍光体が５６重量％、第２の蛍光体が１１重量％、第３の蛍光体が３３重量％である場合、図１８（ｃ）は、第１の蛍光体が６５重量％、第２の蛍光体が２６重量％、第３の蛍光体が９重量％である場合の半導体発光装置の出射光の波長分布を示した図である。

【図１９】　図１９（ａ）は、封止樹脂の重量に対する第１、第２、第３の蛍光体の総重量の比率が０．５である場合、図１９（ｂ）は０．６６である場合、図１９（ｃ）は１．０である場合の半導体発光装置の出射光の波長分布を示した図である。

【図２０】　図１９（ａ）に示した半導体発光装置の発光スペクトル１５０と、人間の比視感度１５１を考慮した半導体発光装置の実効発光スペクトル１５２とを示す図である。

【図２１】　本発明の第１２の実施形態の発光表示装置を示す模式図である。

【図２２】　本発明の発光表示装置が備えるカラーフィルタの分光特性を示した図である。

【符号の説明】

７ａ　半導体発光素子

７ｂ　半導体発光素子

７ｃ　半導体発光素子

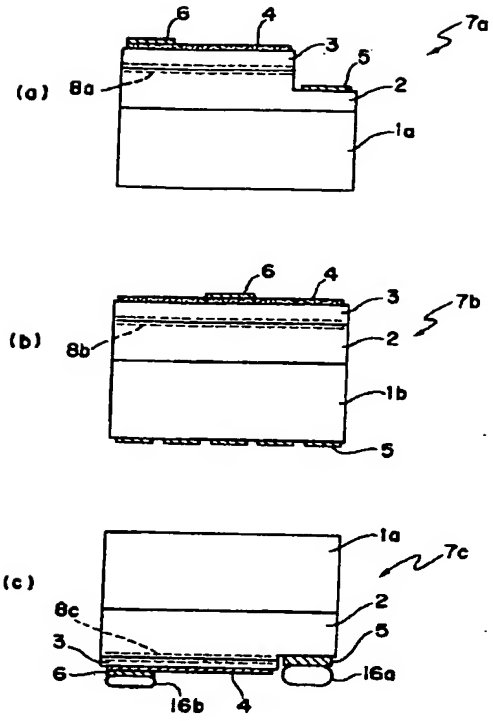
57

１０　リードフレーム

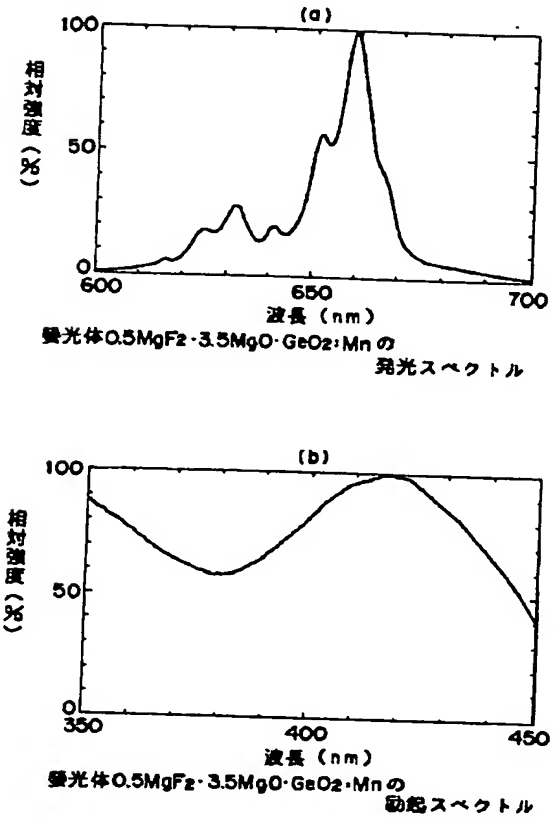
58

１２　蛍光体

【図１】



【図２】



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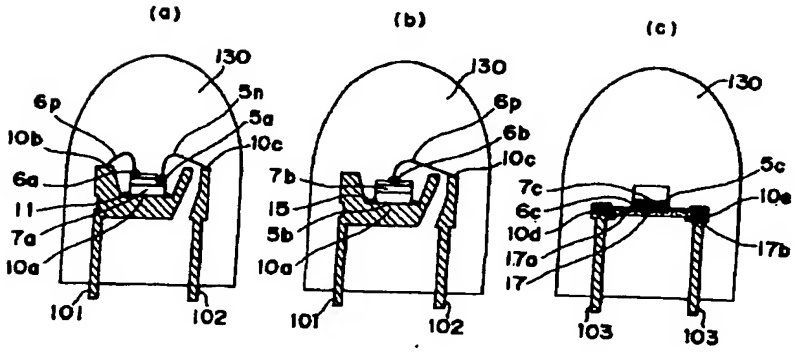
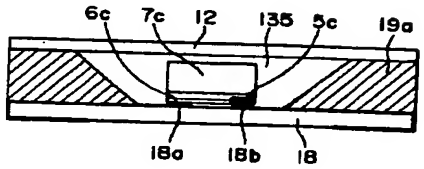
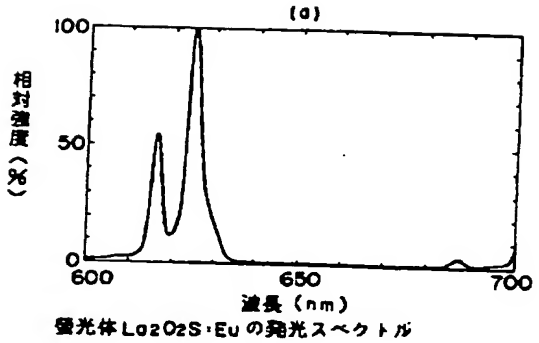


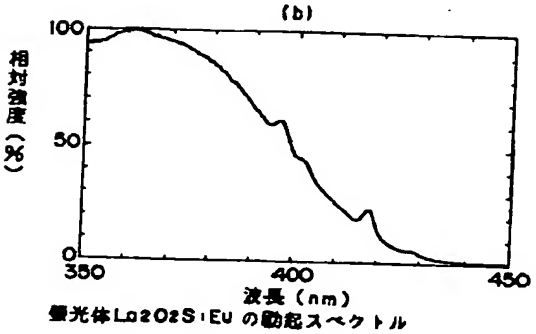
【図１３】



【図３】

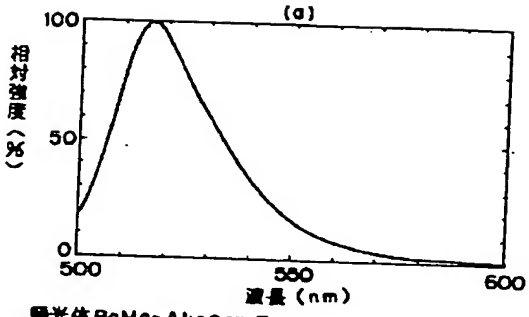


蛍光体La2O2S:Euの発光スペクトル

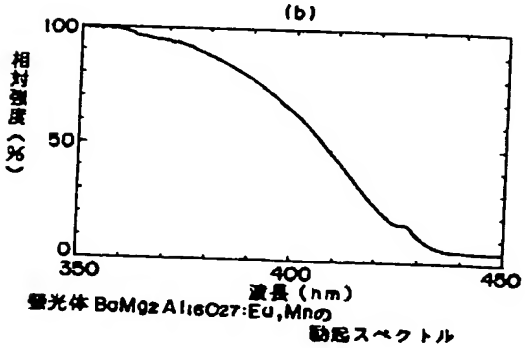


蛍光体La2O2S:Euの励起スペクトル

【図４】

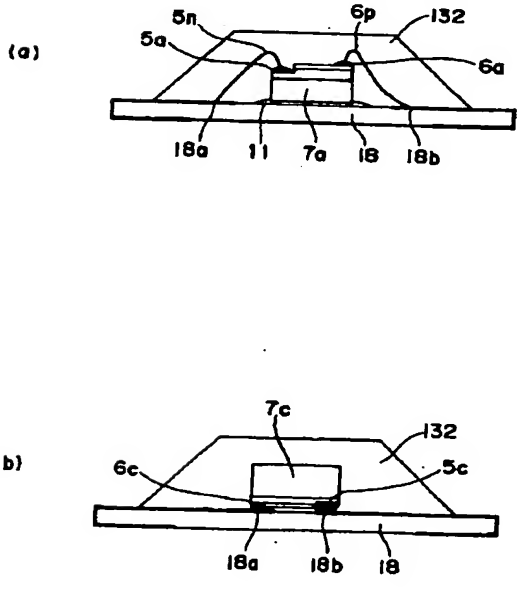


蛍光体BaMg2Al16O27:Eu,Mnの発光スペクトル



蛍光体BaMg2Al16O27:Eu,Mnの励起スペクトル

【図１１】



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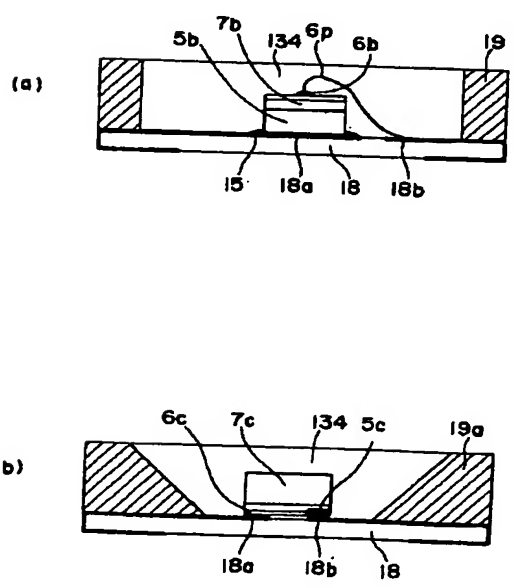
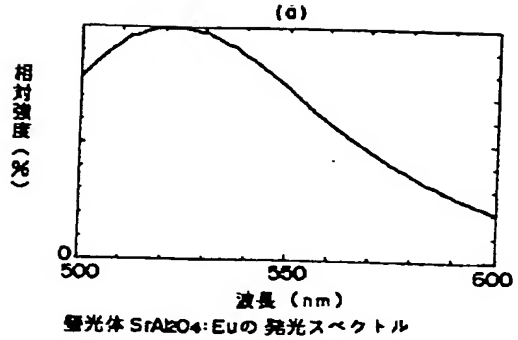
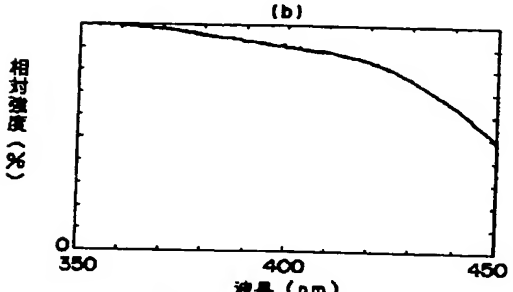


【図５】

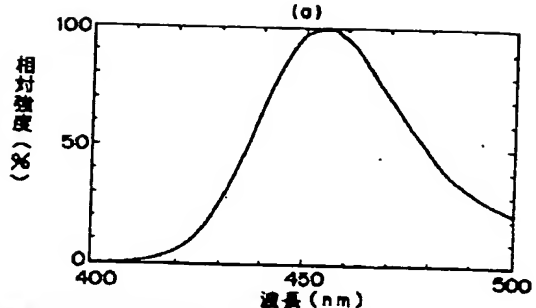


蛍光体 $SrAl_2O_4$:Euの発光スペクトル

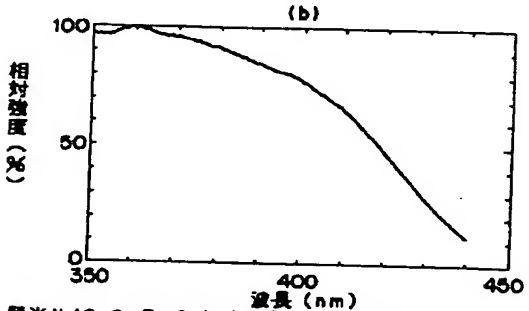


蛍光体 $SrAl_2O_4$:Euの励起スペクトル

【図６】

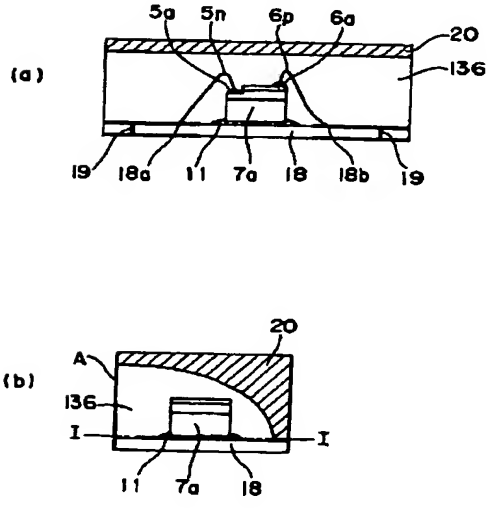


蛍光体 $(Sr,Ca,Ba,Ce)_{10}(PO_4)_6Cl_2$:Euの発光スペクトル

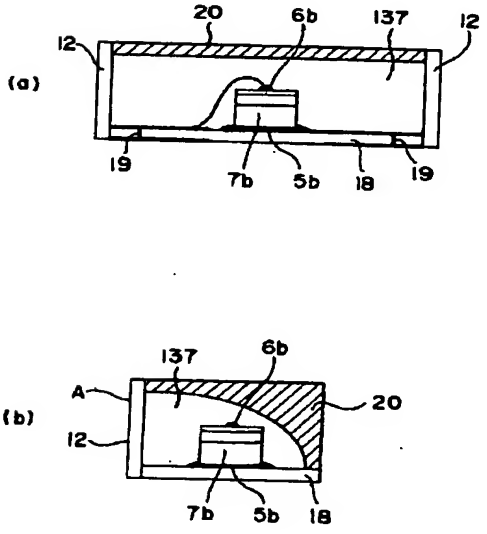


蛍光体 $(Sr,Ca,Ba,Ce)_{10}(PO_4)_6Cl_2$:Euの励起スペクトル

【図１４】



【図１５】



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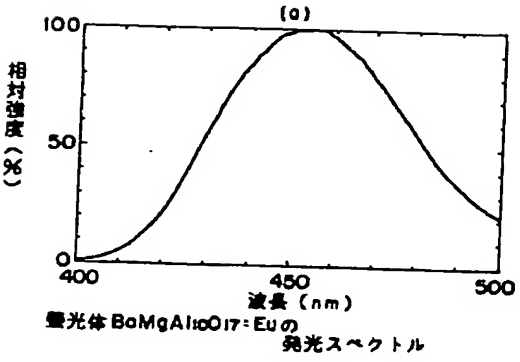
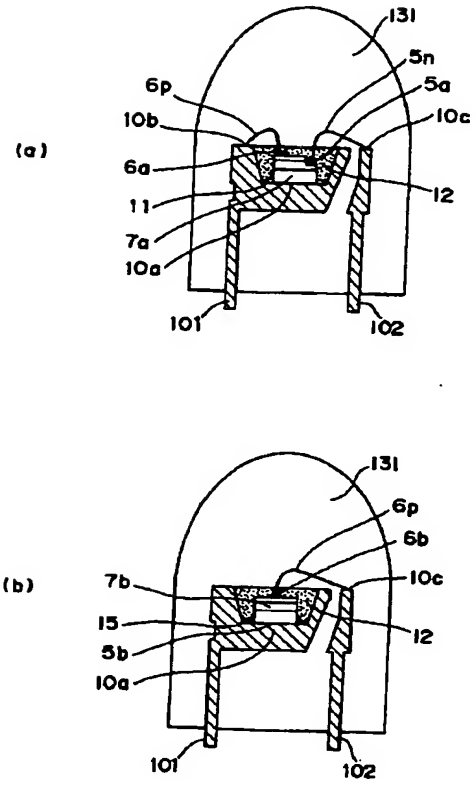


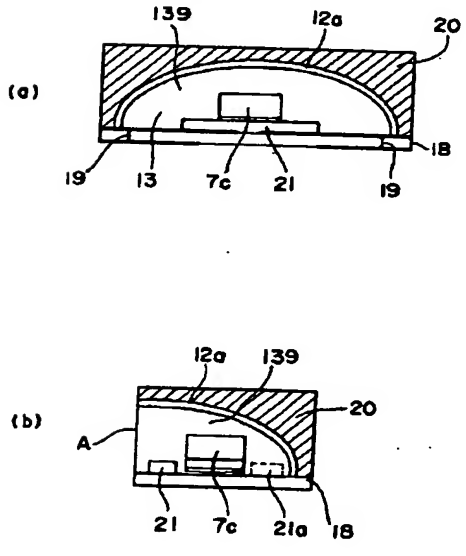
蛍光体 $BaMgAl_{10}O_{17}:Eu$ の発光スペクトル

蛍光体 $BaMgAl_{10}O_{17}:Eu$ の励起スペクトル

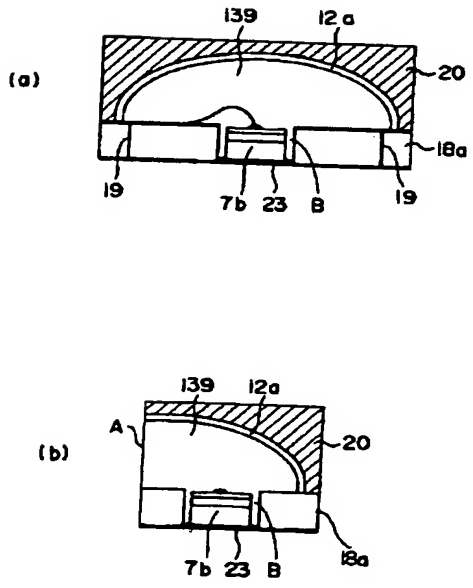
【図９】



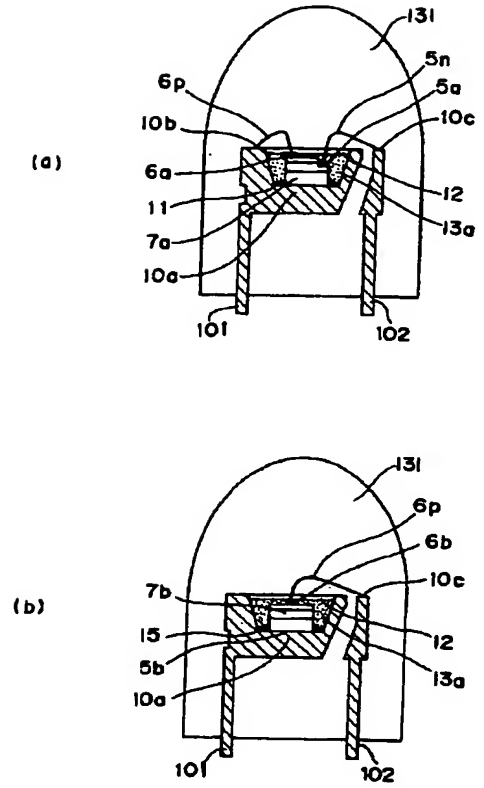
【図１６】



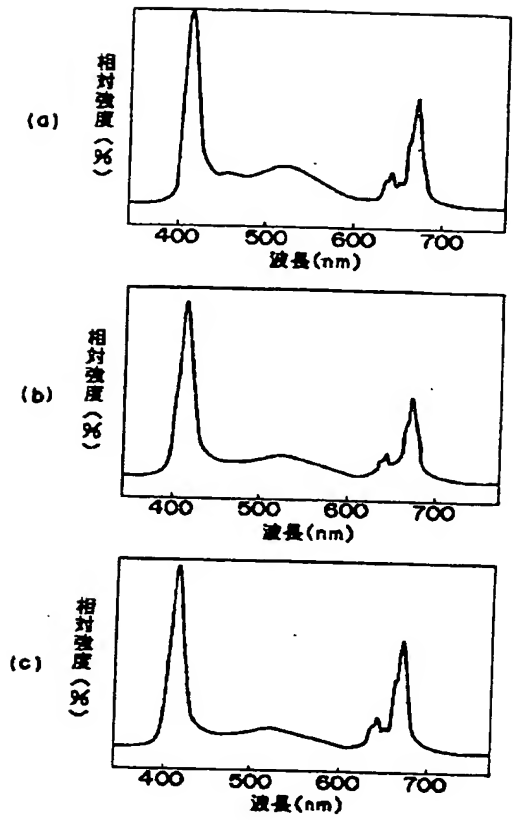
【図１７】



【図１０】



【図１８】



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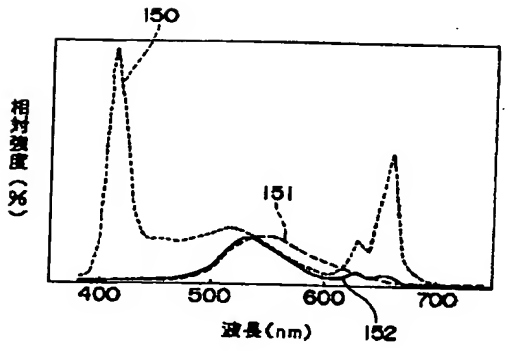
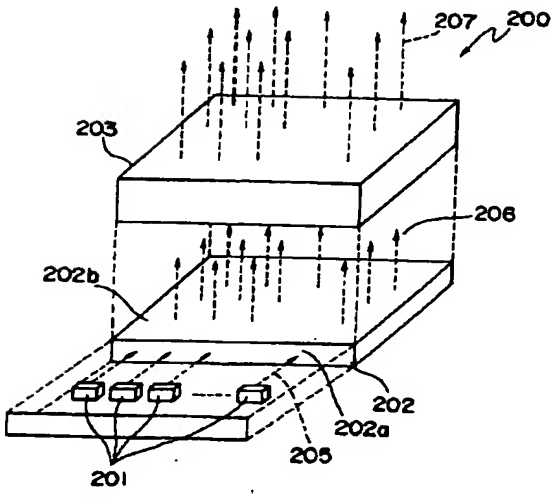
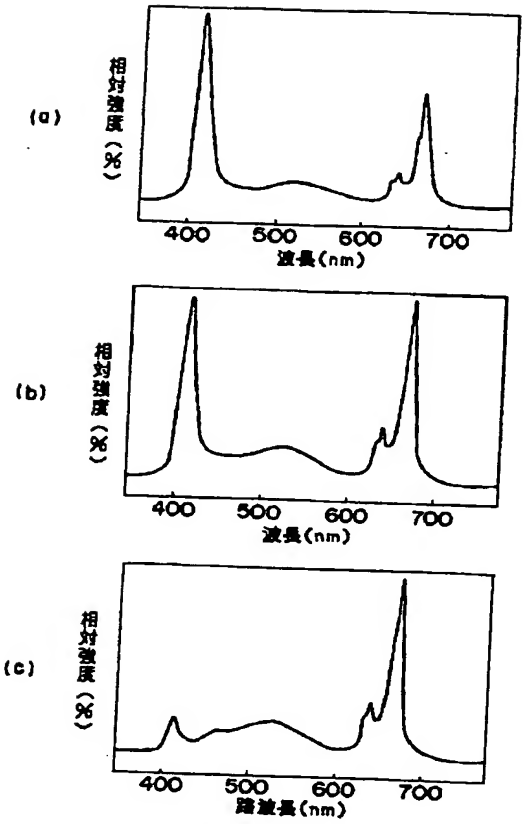


【図２１】



【図１９】



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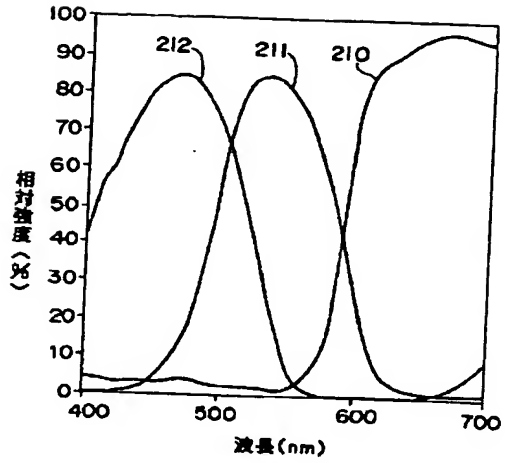

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11/84	CPB CPC CPD CPM CPR CPS CPT CPV CPW	11/84	CPB CPC CPD CPM CPR CPS CPT CPV CPW

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